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RESAMPLING STUDY

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16. Abstract

A comparison of the nearest neighbor and cubic convolution resampling algorithms was performed. The two algo ithms were applied to a variety of images extracted from Landsat MSS data. Results obtained demonstrate that (1) cubic convolution can cause spreading of small features and can introduce noticeable overshoot (ringing) into the data, (2) cubic convolution attenuates the high spatial frequencies compared to the original and nearest neighbor resampled data, and (3) cubic convolution generally produces photographic products of superior visual quality. Although investigated in this study, the effects of the resampling algorithms on multispectral classification were not conclusively determined due to the small number of images tested.

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PREFACE

This is the final report describing the resampling study performed by IBM for the NASA Goddard Space Flight Center under modifications 6 through 9 of contract NAS5-21865. The objective of this effort was to compare the nearest neighbor and cubic convolution resampling algorithms as applied to Landsat MSS data. The comparison was made by evaluating the effects of the resampling algorithms on each of the following categories:

- "Point source" objects
- Spatial frequency content of the data
- Areas of uniform radiance
- Multispectral classification
- Temporal registration
- Human analysis of the images

This report describes the work that was performed, presents copies of the results generated, analyzes those results, and presents conclusions drawn from them.

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Figures for Appendix B

Section 1. SUMMARY OF EFFORT

Five groups of data sets were processed for this investigation. Each was resampled with the nearest neighbor and cubic convolution resampling algorithms, and a comparison of the resulting data arrays was made by evaluating various photographic and statistical products. For a given data set, the sampling lattice used for nearest neighbor resampling was identical to that used for cubic convolution. Any differences in the resulting digital arrays are therefore due solely to the properties of the resampling algorithms. In preparing the photographic products, the original and resampled versions of each data array were processed identically. Hence any differences in the resulting prints are also due solely to the resampling algorithms.

All film products were generated from recordings made on the IBM Drum Scanner/Plotter using a 100 μm square spot. For data arrays whose pixels have a 1.4:1 aspect ratio, the ground scales of the film recordings are approximately 1:560000 horizontally and 1:790000 vertically. For arrays whose pixels have a 1:1 aspect ratio, the ground scale of the recordings is approximately 1:500000 in both directions. Ten-power enlargements were made of all film recordings. These have correspondingly increased ground scales (e.g., 1:79000).

The data sets processed are listed in Figure 1. The generated products are listed in Figure 2 and described below.

Data Set A. - Point Source Objects

To determine the effects of the resampling algorithms on single-pixel, bright objects, a data set containing images of the mirrors placed by W. E. Evans in the vicinity of Reston, Virginia in October 1974, was used. The intensity values surrounding each mirror in the original and resampled arrays were printed. Since the mirrors were within four or five pixels of each other, an 18 pixel by 15 line array was sufficient to contain all the relevant data values. These array printouts are presented in Figures 8 through 10. Figure 3 contains a contact print of the data set, and Figures 5 through 7 contain 10-power enlargements. The locations of the mirrors are marked on the photographic products and data printouts.

Data Set B. - Spatial Frequency Content of the Data

Three arrays were selected to contain features with high spatial frequency content, such as road networks and airports. Each array, in both its original and resampled forms, consists of 128 lines of 128 pixels per line. To determine the effect of resampling on spatial frequency in the horizontal direction, each row (horizontal line) in each array was

transformed using the Fast Fourier Transform (FFT) algorithm. For each line, the power in each frequency was computed from the transform, and, for a given array, the average power was computed as the component-wise average of the power of the 128 lines. To determine the comparable effect in the vertical direction, this process was repeated for each column (vertical line) in the three arrays. Three standard operations were applied to each line of the data before it was transformed:

(1) The mean was removed.
(2) A window was applied (the window was a cosine bell applied to 1/10 of the data at each end).
(3) 128 pad values of zero were appended.

The resulting power plots are shown in Figures 20 - 37.

In addition to the spatial frequency analysis, the original and resampled arrays were plotted, contact printed (Figure 4), and enlarged (Figures 11 - 19). The generated photographic products were evalued by an experienced photointerpreter as to overall quality, clarity, resolution, and information extraction potential.

Data Set C. - Areas of Uniform Radiance

To determine how the resampling algorithms affect areas of near uniform radiance, two such areas were selected: one near Lake of the Woods, Virginia, and the other in the Chesapeake Bay southeast of Point Lookout. The two areas were resampled with both algorithms. Shadeprints are presented in Figures 38 through 43.

Data Set D. - Multispectral Classification and Temporal Registration

A systematic geometric correction was defined for a subimage of scene 2183-16433 which contained Lacie Intensive Test Site #2 in Hand County, South Dakota. Geometric correction parameters were then derived which would register the corresponding area of scene 2165-16435 with it. The Hand County site was chosen for the availability of detailed ground truth maps for a 5 x 6 nautical mile segment. The ground cover in this segment, with the exception of about 2% of the area, consisted of spring wheat, oats, corn, and pasture/grasses, their exact proportions being known from the ground truth inventory.

The ground truth information available for this site is included as Appendix A of this report. It shows that the fields involved varied in size from 1 to 635 acres. Of the 275 fields, 60% were 40 acres or less in size, 27% were from 40 to 100 acres, and 13% were larger than 100 acres. Approximately 55% of the fields had aspect ratios of 2:1 or greater. In most cases, the field boundaries were regular and aligned along section lines.

All four bands of each subimage were resampled with the two resampling algorithms. Contact prints (Figures 44 and 45) and 10X enlargements (Figures 46 -69) for all four bands of each of the two temporally separated scenes were generated and evaluated by an experienced photointerpreter. (Notice that Figures 50 - 57 and 62 - 69 are rotated to fit on the page, even though the figure titles are not.)

The temporal registration that was done for this data set, and for data set e below, used relative control points that were correlated between the reference image and the register image. Prior to the correlation, the prototype features (the windows) and the search areas were resampled with a one-dimensional cubic convolution algorithm to remove the effect of sampling delay and intersweep earth rotation. Based on the locations of the window areas within the corresponding search areas, geometric correction parameters which would effect the temporal registration were derived. This one set of parameters was used to drive both the nearest neighbor and cubic convolution resampling algorithms.

The digital arrays generated by the resamplings were classified using the multispectral classification capabilities of the Earth Resources Interactive Processing System (ERIPS) at IBM - Houston. The accuracy of the proportion estimates obtained by the classification of each resampled version of the data was used as a basis for evaluating the resampling techniques.

The classification model which was used in this study assumes that the data corresponding to each distinct ground cover constitute a normal population. This is the model generally adopted in the classification of remotely sensed data. Implementation of the maximum likelihood classification scheme with this model consisted of the following steps:

- o Designation of training areas for each distinct ground cover from the ground truth maps
- o Computation of the statistics (mean vectors and covariance matrices) to characterize each type of ground cover (class).
- o Classification of the data into the defined classes by a maximum likelihood rule.
- o Generation of classification maps and/or summaries of classifi- results for training and test fields.

There were mainly two considerations in the selection of training fields from the ground truth inventory. First, it was desired to define training areas to be entirely in the interior of fields so that the boundary pixels, where the larger differences due to resampling show up, would not be included. This eliminated narrow, small fields from being included in training. The second consideration was to give a roughly proportional representation in terms of size and number of training fields to each of the four major ground cover types: spring wheat, oats, corn, and pasture/grasses. Once the training fields were defined, mean and standard deviation statistics were computed for each class. Using the maximum likelihood decision rule, the test and training fields were classified for each image separately. Each pixel was assigned to one of the classes defined by the training fields.

The areal proportion estimate of each ground cover category was computed directly as the proportion of pixels assigned to classes defined by the training fields of this category. As noted earlier, roughly 2% of the area had ground cover unlike any represented by the training fields. It was assumed that these pixels would be classified into the defined categories proportionally by area. The proportion estimates obtained are summarized in Figure 70.

Data Set E. Temporal Registration

Scene 1921-18022 was used as the reference image and 1813-18063 was the register image. Only band 5 of two subimage areas was processed. Contact prints (Figures 80 and 81), 10X enlargements (Figures 82-93), and shade-prints (Figures 94-105) were generated. The photographic products were examined by an experienced photointerpreter.

Section 2. EVALUATION AND CONCLUSIONS

The output generated by the effort described above was evaluated, resulting in the following observations and conclusions:

1. Cubic convolution may introduce "overshoot" into the resampled data. This effect is clearly seen in the black borders surrounding the mirrors in the vicinity of Reston, VA. (Figures 7A and 7B) and the small white area at the left center of area 2, 1921-18022 (Figure 87). Although not demonstrated in this investigation, theoretical considerations imply that the overshoot is highly dependent on the sampling lattice. A slight shift of the input space relative to the sampling lattice may produce significantly altered resampled values at the same lattice points. In this sense, and in this admittedly extreme situation, cubic convolution is an inaccurate algorithm for interpolating to inter-pixel values.

2. Cubic convolution may cause a significant spreading of small features. This spreading was noticed more severely in the vertical (along-track) as opposed to the horizontal direction. In the original and nearest neighbor data, the southeastern mirror near Reston, VA appears to have affected only one horizontal line, but in the cubic convolution data, four lines (including the overshoot) are affected.

3. Cubic convolution can effectively remove discontinuities in the data due to subpixel offsets. Such offsets are introduced into the Landsat MSS data by sampling delay, differences in scan line length, and the intersweep earth rotation effect. Nearest neighbor resampling cannot effectively remove these discontinuities and, as a result, photographic products generated from the cubic convolution data are visually much smoother than comparable products generated from nearest neighbor data. Under appropriate conditions, nearest neighbor data gives the appearance of containing two pixel discontinuities.

   Incorporation of a correction for these distortions is optional in either resampling algorithm. It was not included in the resamplings of data sets A, B, and C since the characteristics investigated in these data sets (spreading, effect on spatial frequency, etc.) do not depend on subpixel effects. However, to permit a more accurate temporal registration, the subpixel effects were compensated for in data set D and E. The compensation was incorporated in both the cubic convolution and nearest neighbor algorithms. A comparison of linear features in data sets D and E demonstrates the smoothing effect cubic convolutions can provide in photographic products.

4. The photointerpreter who evaluated the photographic products found that, compared to the original data, nearest neighbor resampling produces a geometric "dappling" of the finer details in the data. There is not a smooth transition among neighboring pixels of slightly differing gray-scale values (see Figure 52). Straight edges such as field patterns, runways and roads appear more stepped and jagged than in the original data (Figure 52, Figure 18). At times however, there appears to be an enhancement over the original data of smaller terrian patterns (northeast quadrant, Figure 86).

The cubic convolution algorithm reduces the "dappled" appearance of small terrain details (Figure 63 and Figure 67) and makes small stream patterns appear more realistic (Figure 67). It reduces the stepped appearance along the edges of fields (Figure 65 and Figure 69) and on airfield runways (Figure 18 and Figure 19), and it appears to promote natural appearing patterns in areas with finer terrain detail (Figure 87, northeast quadrant). In small, single pixel areas of high contrast relative to their surroundings, the algorithm tends to "overshoot" and produce radiometric values of almost certainly misleading contrast (Figure 7a, 7b).

As a result, it appears that cubic convolution is preferable to nearest neighbor in processing the image data to further its interpretability. Cubic convolution does the better job of smoothing edges known to be straight. It promotes a gradational gray-shade transition among smaller terrain details which increases the interpreter's ability to recognize otherwise obscure and subtle terrain patterns. However, it has the negative attribute of "overshooting" small areas of high contrast relative to the surroundings, and thereby promotes a misleading pattern.

5. Cubic convolution attenuates the high spatial frequencies, whereas nearest neighbor has essentially no effect on spatial frequencies. The attenuation caused by cubic convolution was nearly identical in both the horizontal and vertical directions and was noticed equally in all cases tested. Given that the transforms which were computed used 128 points, the lowest spatial frequency detected in the horizontal direction (excluding the 'DC' or constant term) is

$$\frac{1}{128 \text{ Samples} \times 57.2 \text{ Meters/Sample}} = \frac{1}{7321.6 \text{ Meters}}$$

an the highest spatial frequency is

$$\frac{1}{2 \text{ Samples} \times 57.2 \text{ Meters/Sample}} = \frac{1}{114.4 \text{ Meters}}$$

Within this range, the power plots show that cubic convolution begins attenuating spatial frequencies at a frequency of approximately

$$\frac{44}{(128 \text{ X } 57.2) \text{ Meters}} = \frac{1}{166.4 \text{ Meters}}.$$

The attenuation becomes progressively more severe until the power in the highest frequency (1/114.4 Meters) is attenuated by approximately a factor of 2.

The same occurence is noticed in the vertical direction. In this case, the range of spatial frequencies is

$$\frac{1}{128 \text{ X } 79} = \frac{1}{10112 \text{ Meters}} \text{ to } \frac{1}{2 \text{ X } 79} = \frac{1}{158 \text{ Meters}}.$$

The attenuation begins at a spatial frequency of approximately

$$\frac{44}{(128 \text{ X } 79)} = \frac{1}{229.82 \text{ Meters}}.$$

and the attenuation is again approximately a factor of two at the highest frequency.

6. In areas of near-uniform radiance, the differences in the output due to choice of resampling algorithm are minimal. Cubic convolution data does have a lower standard deviation in such areas (and in the image as a whole). As a result, the cubic convolution algorithm may be considered preferable in that it reduces the noise in the input data.

7. The multispectral classification experiment performed as part of this investigation suggests that the differences due to choice of resampling algorithm in the proportion estimates for various ground cover types are insignificant (see Figure 70).

   Analysis of the data shows that: (a) although the differences in proportion estimates are not significant, the number of pixels classified differently in the two resampled versions is large for each scene; and, (b) the differences in the two resampled versions are characterized by zero mean Gaussian noise.

   The interiors of the fields in cubic convolution images are more homogeneous (lower standard deviations) and the transitions at the field boundaries are smoother as compared to the nearest neighbor images. Comparison of the field structure in the images with the ground truth maps showed the cubic convolution images to be 'truer' to the scene. This is a qualitative judgment based on visual comparisons of field sizes and boundaries.

The classification results obtained should be qualified by the following considerations.

a. The classification procedure is usually based on a model for the data. The model generally used with remotely sensed agricultural data assumes that the data corresponding to each distinct ground cover type constitute a normal (mixture) population. This model was adopted in this study even though it fails the test of statistical hypothesis that the mean vectors of any two fields of the same type have been drawn from a single normal distribution. This points to a weakness in the model for the data on which the classification was based and, therefore, a weakness in using these classification results as a basis for evaluation of the resampling techniques.

b. From the viewpoint of classification, the smoothing mechanism of cubic convolution would introduce additional spatial correlation in the data and reduce the within-field variability. Note that even without resampling, spatial correlation is introduced in the data by the sensor dynamics, atmosphere, and the current sampling procedures. The effect of increased correlation on classification is difficult to study analytically; however, the following qualitative remarks apply.

   o The training data, corresponding to contiguous pixels in a field, are assumed to be independent. Clearly, with cubic convolution resampling, this assumption is harder to justify. The estimates of the class covariance matrices obtained as though the data were independent would be biased and the spread in the data would be underestimated.

   o The smoothing process would tend to decrease the 'distance' (e.g., divergence, Bhattacharyya distance) between different classes. This would be particularly true for scenes with narrow fields.

   o The separability of data corresponding to different ground covers in a scene changes with time. The impact of the smoothing process of cubic convolution on classification, therefore, depends upon the time of data acquisition and would be greater when this separability is small and vice versa.

With the training areas defined so as not to include boundary pixels, the nearest neighbor resampling would not affect the training statistics and its impact on classification would be seen only in the boundary pixels whose identities got changed in the resampling process. Clearly, this impact would vary depending upon the field structure in the scene.

In summary, the classification results have not provided a conclusive basis for the evaluation of the two resampling techniques. The images generated by cubic convolution are visually of a superior quality and 'truer' to the scene on the ground. This, however, does not necessarily mean that the cubic convolution images can be classified more accurately by a given classifier. Nor does it mean that a classifier can not be developed to give better classification results with the cubic convolution images as compared to those obtained with the nearest neighbor images, or as compared to the results obtained with the given classifier with the images generated by either resampling procedure.

8. Regarding temporal registration, images produced by cubic convolution resampling have a smoother visual quality and, correspondingly, a lower standard deviation in near-uniform areas. If the images generated by a temporal registration correction are to be differenced and used for change detection, this smoothing effect of cubic convolution may be desirable, since it may reduce the "speckling" of the difference image. Alternatively, if the temporally registered images are to be used as additional channels in a multispectral classification experiment, results presented in the preceeding paragraph suggest that either resampling algorithm may work equally well.

Section 3. RECOMMENDATIONS

1. Variations in the present cubic convolution algorithm should be investigated to determine whether they would lead to improved results. Possible variations are:

   a. Modify the cubic convolution interpolation done in the horizontal direction to account for oversampling. As presently implemented, identical interpolations are performed in both the horizontal (oversampled) and vertical (non-oversampled) directions.

   b. Apply cubic convolution in the horizontal direction only. It is in this direction that subpixel discontinuities are known to exist, and, by not resampling in the vertical direction, the undesirable overshoot occurrences noticed in Data Set A may be avoided. Processing loads would be significantly reduced if this were done.

2. A more complete investigation of the effects of resampling on multispectral classification should be performed. The proportion estimates obtained with the two temporally separated images of this experiment (either resampled version) are significantly different from each other. These differences arise due to the changes with time in the spectral separability of data for different ground cover types in the scene. The results obtained with the earlier image are far too different from the ground truth in each case to be of any value in a study of the impact of resampling procedures. Those obtained with the second image, though closer to the ground truth by comparison, only constitute a sample of one from which to draw a conclusion. A meaningful conclusion may be possible from a larger study involving several scenes with multiple acquisitions of imagery over each.

3. To determine which resampling method reconstructs "truth" more accurately in the photographic products, "truth" must be known. High resolution aircraft photography of an area, taken at the same time and in the same spectral band, may be used as a reference. Such an evaluation should be done to determine whether cubic convolution is introducing patterns (e.g., moires) into the resampled data.

Data Set	Feature	Description	Scene and Band	Approximate Pixel Coordinates Of Subimage Center (Sample, Line)	Subimage Size Samples x Lines	Pixel Aspect Ratio	Type of Geometric Correction
A	Point Sources	Reston Mirrors	1800-15081-4,5	880,1610	100 x 100	1.4:1	Systematic
B	High Spatial Frequency	Aberdeen Proving Grounds		2240,180	128 x 128	1.4:1	Scene
		Wheaton, Md Road Network	1080-15192-4	1226,965			
		Andrews AFB		1555,1226			
C	Uniform Radiance	Lake of the Woods	1080-15192-7	480,2050	100 x 100	1.4:1	Scene
		Chesapeake Bay SE of Point Lookout		3080,2291			
D	Classification/ Temporal Registration	Lacie Intensive test site, Hand County #2, South Dakota	2183-16435 all bands	2355,1594	200 x 200	1:1	Systematic
			2165-16433 all bands	2410,1259			Temporal Registration
E	Temporal Registration	Area 1	1921-18022-5	1830,271 500,380	200 x 200	1.4:1	Systematic
		Area 2 Both in vicinity of Monterey, California	1813-18063-5	1718,452 377,557			Temporal Registration

Figure 1. Table of Data Sets Processed

Notes:

1. Band designations are those used for Landsat 1, for which the four spectral bands of the MSS were numbered 4 through 7 in order of increasing wavelength.
2. Systematic corrections are those which can be made without reference to the sensor data. Scene corrections and temporal registration require the use of control points which must be located in the sensor data.
3. A resampling of this data set to produce pixels with a 1:1 aspect ratio is described in Appendix B of this report.

Data Set	Feature	Contact Prints of Recordings With 100 μm Spot	10X Enlargements	Data Printouts	Evaluation by Experienced PI	FFT	Shadeprints	Classification on ERIPS
A	Point Sources	X	X	X				
B	High Spatial Frequency	X	X		X	X		
C	Uniform Radiance						X	
D	Classification/Temporal Registration	X	X					X
E	Temporal Registration	X	X				X	

Figure 2. Table of Photographic and Statistical Products Generated

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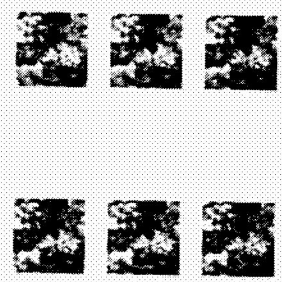
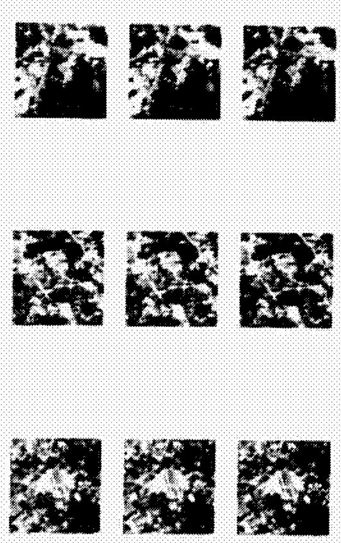


band 4

band 5

Figure 3. Contact print of Reston mirrors, OR,NN,CC-1800-15081-4,5

OR NN CC



Aberdeen Proving Grounds

Suburban Road Network,
Wheaton, MD

Andrews Air Force Base

Figure 4. Contact print of Aberdeen, Wheaton and Andrews AFB,
OR,NN,CC-1080-15192-4

Figure 5a. 10X Enlargement of Reston Mirrors, OR-1800-15081-4

Figure 5b. 10X Enlargement of Reston Mirrors, OR-1800-15081-5

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Figure 6a. 10X Enlargement of Reston Mirrors, NN-1800-15081-4

Figure 6b. 10X Enlargement of Reston Mirrors, NN-1800-15081-5

Figure 7a. 10X Enlargement of Reston Mirrors, CC-1800-15081-4

Figure 7b. 10X Enlargement of Reston Mirrors, CC-1800-15081-5

PIXEL INTENSITY VALUES AROUND MIRRORS AT RESTON   ORIGINAL DATA   1800-15081-4

RINTOUT OF INTENSITY VALUES OF PIXELS SURROUNDING SAMPLE   52, LINE   51

	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
LINE 44	21	21	23	23	21	21	21	21	21	23	23	23	21	21	21	21	21	23
LINE 45	20	20	20	22	20	20	20	20	20	20	20	27	20	22	22	22	22	22
LINE 46	21	21	21	21	21	25	24	21	20	21	21	21	21	21	21	21	21	21
LINE 47	20	20	20	22	22	24	22	24	24	24	24	29	22	22	22	22	22	22
LINE 48	20	20	22	22	22	22	23	22	20	20	23	26	27	6	23	20	22	22
LINE 49	23	23	23	23	25	29	45	29	20	22	22	22	22	23	25	25	23	22
LINE 50	23	21	21	23	27	31	3	37	33	31	27	22	23	23	23	23	23	26
LINE 51	20	22	20	22	23	26	9	35	37	35	27	22	22	22	20	20	20	20
LINE 52	25	26	25	24	110	83	25	34	30	34	34	28	21	21	21	21	21	21
LINE 53	26	24	24	25	20	32	29	30	29	30	30	29	25	21	24	20	22	22
LINE 54	23	26	27	23	26	23	26	27	27	29	29	44	127	127	22	29	23	22
LINE 55	29	28	25	25	25	29	31	29	29	29	28	29	31	29	23	21	22	25
LINE 56	26	24	29	27	26	26	24	27	31	31	29	27	26	26	26	26	26	27
LINE 57	26	26	29	27	23	29	29	26	23	26	26	27	27	29	27	27	27	26
LINE 58	25	26	25	26	28	45	48	25	25	28	26	26	28	30	26	26	30	28

PIXEL INTENSITY VALUES AROUND MIRRORS AT RESTON   ORIGINAL DATA   1800-15081-5

PRINTOUT OF INTENSITY VALUES OF PIXELS SURROUNDING SAMPLE   52, LINE   51

	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
LINE 44	13	13	13	13	13	13	13	12	13	12	13	13	13	13	13	13	13	14
LINE 45	14	12	12	12	12	12	12	14	12	14	14	14	12	12	14	14	14	14
LINE 46	13	13	13	12	16	17	15	13	13	13	13	13	13	13	13	13	13	13
LINE 47	12	12	14	14	15	16	14	16	16	16	14	14	14	14	14	12	12	14
LINE 48	13	13	14	13	14	14	14	14	13	14	15	20	21	20	16	13	13	14
LINE 49	14	15	15	16	16	25	45	23	14	14	12	12	14	16	19	18	15	14
LINE 50	14	14	13	14	20	24	27	31	26	24	21	13	12	13	13	13	15	18
LINE 51	14	14	14	14	15	20	23	29	35	29	21	14	14	14	12	14	12	12
LINE 52	21	21	17	19	112	71	23	28	28	30	30	21	15	13	13	13	12	12
LINE 53	18	15	13	18	29	29	24	24	24	25	28	22	15	12	12	14	14	14
LINE 54	16	19	19	19	19	16	20	21	21	25	25	45	127	127	98	25	15	14
LINE 55	24	23	19	19	23	25	28	25	24	24	24	25	25	24	16	14	15	19
LINE 56	23	16	26	23	16	18	16	24	27	24	24	20	21	18	18	20	20	23
LINE 57	20	17	27	21	17	27	23	16	17	23	21	24	27	23	23	24	21	21
LINE 58	21	28	25	21	25	51	47	16	21	24	24	25	25	25	21	23	25	24

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Figure 8. Pixel value printouts around Reston mirrors, OR-1800-1508 4,5

PIXEL INTENSITY VALUES AROUND MIRRO___AT RESTON NEAREST NEIGHBOR 1800-15081-4

PRINTOUT OF INTENSITY VALUES OF PIXELS SURROUNDING SAMPLE 52, LINE 51

	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
LINE 44	21	21	21	21	21	21	25	24	21	20	21	20	22	20	22	22	22	22
LINE 45	22	20	20	20	22	22	24	22	24	24	24	21	21	21	21	21	21	21
LINE 46	22	20	20	22	22	22	22	23	22	20	24	24	24	22	22	22	22	22
LINE 47	23	23	23	23	25	29	46	29	20	20	20	23	26	27	26	23	20	22
LINE 48	23	21	21	23	27	31	33	37	20	22	22	22	22	23	25	25	23	22
LINE 49	20	22	20	22	23	26	29	35	33	31	27	23	23	23	23	23	23	26
LINE 50	25	26	25	24	110	83	25	35	37	35	27	22	22	22	20	20	20	20
LINE 51	26	24	24	25	30	32	25	34	30	34	34	28	21	21	21	21	21	21
LINE 52	23	26	27	23	26	23	29	30	29	30	30	29	25	24	24	20	22	22
LINE 53	29	28	25	25	25	23	26	27	27	29	29	44	127	127	22	29	23	22
LINE 54	26	24	29	27	25	29	31	29	29	29	28	29	31	29	23	22	22	25
LINE 55	26	26	29	27	26	26	24	27	31	31	29	27	26	26	26	26	26	27
LINE 56	25	26	28	27	23	29	29	26	22	26	26	27	27	29	27	27	27	26
LINE 57	26	29	26	28	45	48	25	25	26	26	26	28	28	30	26	26	30	28
LINE 58	26	27	30	32	33	30	26	25	26	24	26	29	29	26	29	30	29	26

PIXEL INTENSITY VALUES AROUND MIRRORS AT RESTON NEAREST NEIGHBOR 1800-15081-5

PRINTOUT OF INTENSITY VALUES OF PIXELS SURROUNDING SAMPLE 52, LINE 51

	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
LINE 44	13	13	13	13	12	16	17	15	13	13	13	14	14	12	12	14	14	14
LINE 45	14	12	12	14	14	15	16	14	16	16	16	13	13	13	13	13	13	13
LINE 46	14	13	13	14	13	14	14	14	14	13	16	14	14	14	14	14	12	12
LINE 47	14	15	15	16	16	25	45	23	14	13	14	15	20	21	20	16	13	13
LINE 48	14	14	13	14	20	24	27	31	14	14	17	12	14	16	19	18	15	14
LINE 49	14	14	14	14	15	20	23	29	26	24	21	13	12	13	13	13	15	18
LINE 50	21	21	17	19	112	71	23	29	35	29	21	14	14	14	12	14	12	12
LINE 51	16	15	15	18	29	29	23	28	28	30	30	21	15	13	13	13	12	12
LINE 52	16	19	19	19	19	16	24	24	24	25	26	22	15	12	12	14	14	14
LINE 53	24	23	19	19	23	16	20	21	21	25	25	45	127	127	98	25	15	14
LINE 54	23	16	26	23	23	25	28	25	24	24	24	25	28	24	17	14	15	19
LINE 55	20	17	27	21	16	18	16	24	27	24	24	20	21	18	18	20	20	23
LINE 56	21	28	25	21	17	27	23	16	17	23	21	24	27	28	23	24	21	21
LINE 57	23	25	21	25	51	47	16	21	24	24	24	25	25	25	21	23	25	24
LINE 58	20	25	26	31	31	25	19	19	23	23	23	24	24	22	24	25	23	24

Figure 9. Pixel value printouts around Reston mirrors, NN-1800-15081-4,5

PIXEL INTENSITY VALUES AROUND MIRRORS RESTON CUBIC CONVOLUTION 1800-15081-4

PRINTOUT OF INTENSITY VALUES OF PIXELS SURROUNDING SAMPLE 52, LINE 51

	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
LINE 44	20	20	20	20	20	20	23	21	19	19	19	19	21	20	21	21	21	21
LINE 45	21	20	20	20	21	23	25	22	22	22	23	22	21	20	20	21	21	21
LINE 46	20	18	20	21	21	22	20	19	22	22	22	25	25	24	23	21	21	22
LINE 47	21	21	22	22	22	22	34	33	19	17	20	23	25	25	25	22	21	22
LINE 48	23	22	21	22	25	28	40	40	26	25	25	22	21	22	23	25	24	23
LINE 49	20	20	14	22	14	17	26	35	38	36	29	22	22	22	21	21	21	23
LINE 50	22	24	23	16	73	69	30	32	34	35	32	25	21	21	20	19	19	14
LINE 51	26	25	24	23	76	67	29	31	28	31	33	29	14	11	21	20	21	21
LINE 52	23	24	25	23	18	20	27	27	27	29	29	35	74	74	25	23	22	21
LINE 53	20	27	25	23	15	25	29	27	27	28	28	46	109	100	18	27	22	22
LINE 54	26	25	26	25	26	28	27	29	31	30	28	23	13	14	25	22	23	20
LINE 55	24	26	26	25	24	24	23	27	26	28	27	26	25	26	26	26	26	26
LINE 56	25	27	27	23	30	42	34	21	23	26	26	27	28	29	26	27	27	26
LINE 57	25	27	28	27	36	45	32	21	26	28	27	27	29	27	25	28	30	27
LINE 58	24	26	24	33	32	32	31	29	25	26	25	26	29	27	20	29	29	26

PIXEL INTENSITY VALUES AROUND MIRRORS AT RESTON CUBIC CONVOLUTION 1800-15081-5

PRINTOUT OF INTENSITY VALUES OF PIXELS SURROUNDING SAMPLE 52, LINE 51

	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
LINE 44	13	13	12	12	12	14	14	13	12	12	13	13	13	12	12	13	13	13
LINE 45	12	11	12	13	14	16	16	14	14	15	14	12	12	12	13	12	12	12
LINE 46	13	11	13	13	13	14	11	10	14	15	15	15	18	18	16	13	11	12
LINE 47	12	14	14	15	13	15	29	27	12	11	12	14	18	19	19	17	14	13
LINE 48	13	14	13	14	16	22	36	35	21	17	17	12	10	12	16	17	15	15
LINE 49	13	12	12	14	5	10	20	28	33	30	24	15	11	13	12	12	13	15
LINE 50	18	19	16	10	71	60	25	26	32	32	27	18	15	14	12	13	12	10
LINE 51	20	17	15	16	78	60	26	25	25	27	31	22	6	1	3	11	12	12
LINE 52	15	16	17	18	13	16	21	21	21	24	26	32	67	65	52	20	14	14
LINE 53	20	22	17	18	20	20	24	22	21	24	25	47	109	104	76	19	14	15
LINE 54	22	19	22	20	20	21	23	26	26	23	23	17	8	4	5	15	17	21
LINE 55	16	18	28	18	15	17	15	21	23	23	21	20	22	20	20	22	21	22
LINE 56	21	25	23	16	30	45	26	12	20	23	22	26	28	26	22	23	21	22
LINE 57	25	26	23	25	38	46	24	14	22	24	24	24	24	22	21	24	25	23
LINE 58	18	22	27	31	32	30	29	23	21	21	21	23	24	22	21	23	22	22

Figure 10. Pixel value printouts around Reston mirrors, CC-1800-15081-4,5

Figure 11. 10X Enlargement of Aberdeen Area, OR-1080-15192-4

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Figure 12. 10X Enlargement of Aberdeen Area, NN-1080-15192-4

Figure 13. 10X Enlargement of Aberdeen Area, CC-1080-15192-4

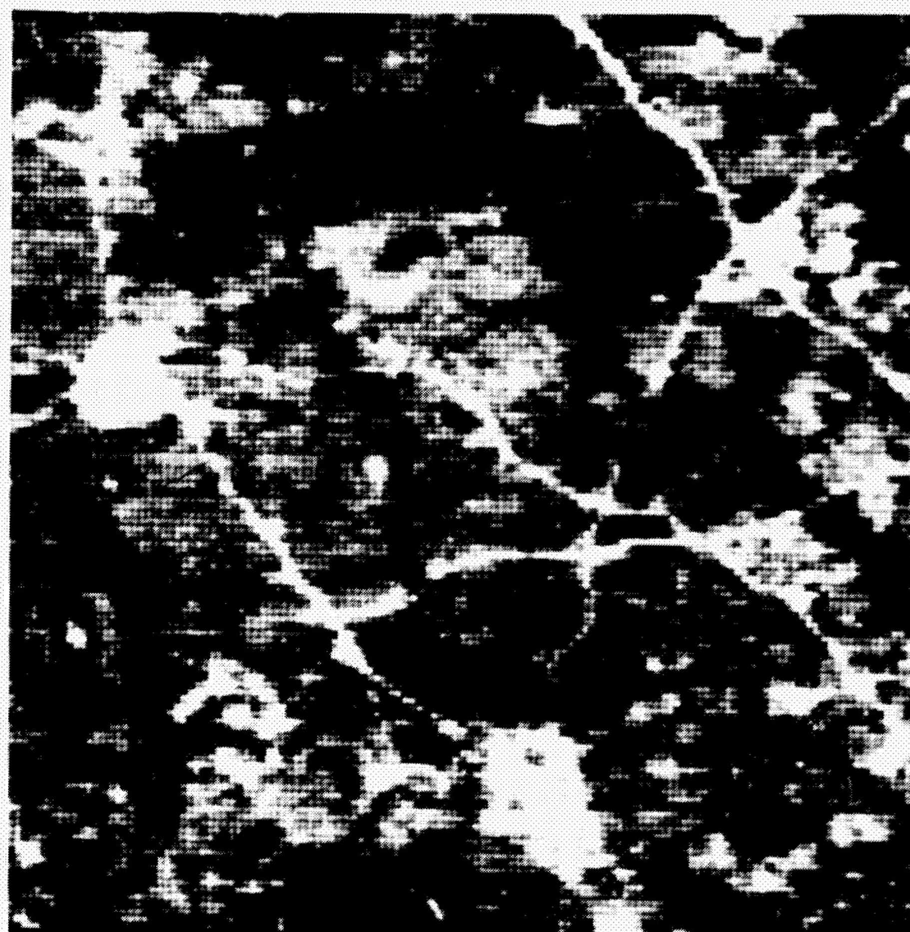

Figure 14. 10X Enlargement of Wheaton Area, OR-1080-15192-4

Figure 15. 10X Enlargement of Wheaton Area, NN-1080-15192-4

Figure 16. 10X Enlargement of Wheaton Area, CC-1080-15192-4

Figure 17. 10X Enlargement of Andrews AFB, OR-1080-15192-4

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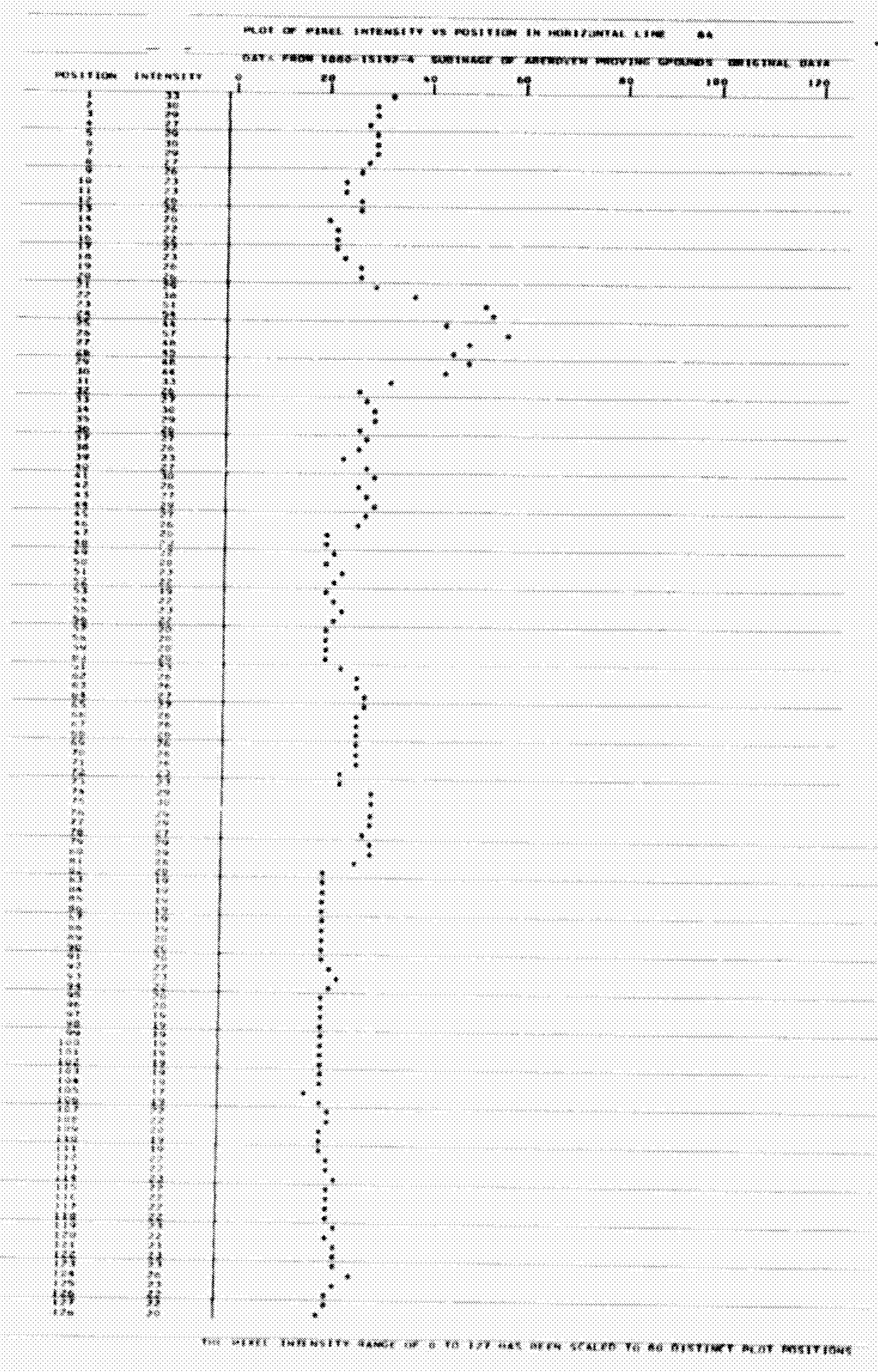
Figure 18. 10X Enlargement of Andrews AFB, NN-1080-15192-4

Figure 19. 10X Enlargement of Andrews AFB, CC-1080-15192-4



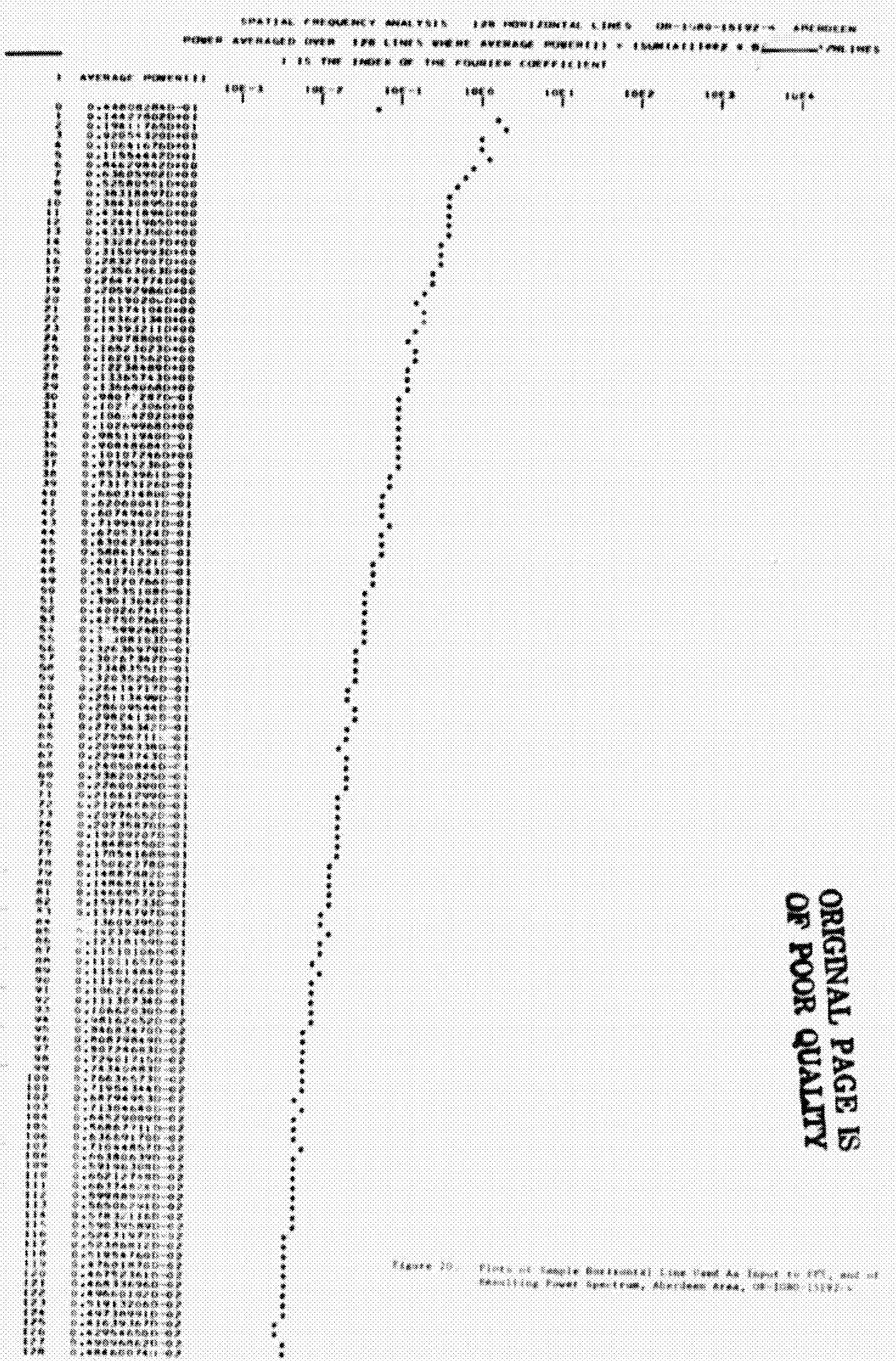


Figure 20. Plots of Sample Horizontal Line Used As Input to FFT, and of Resulting Power Spectrum, Aberdeen Area, OR-1080-15192-4

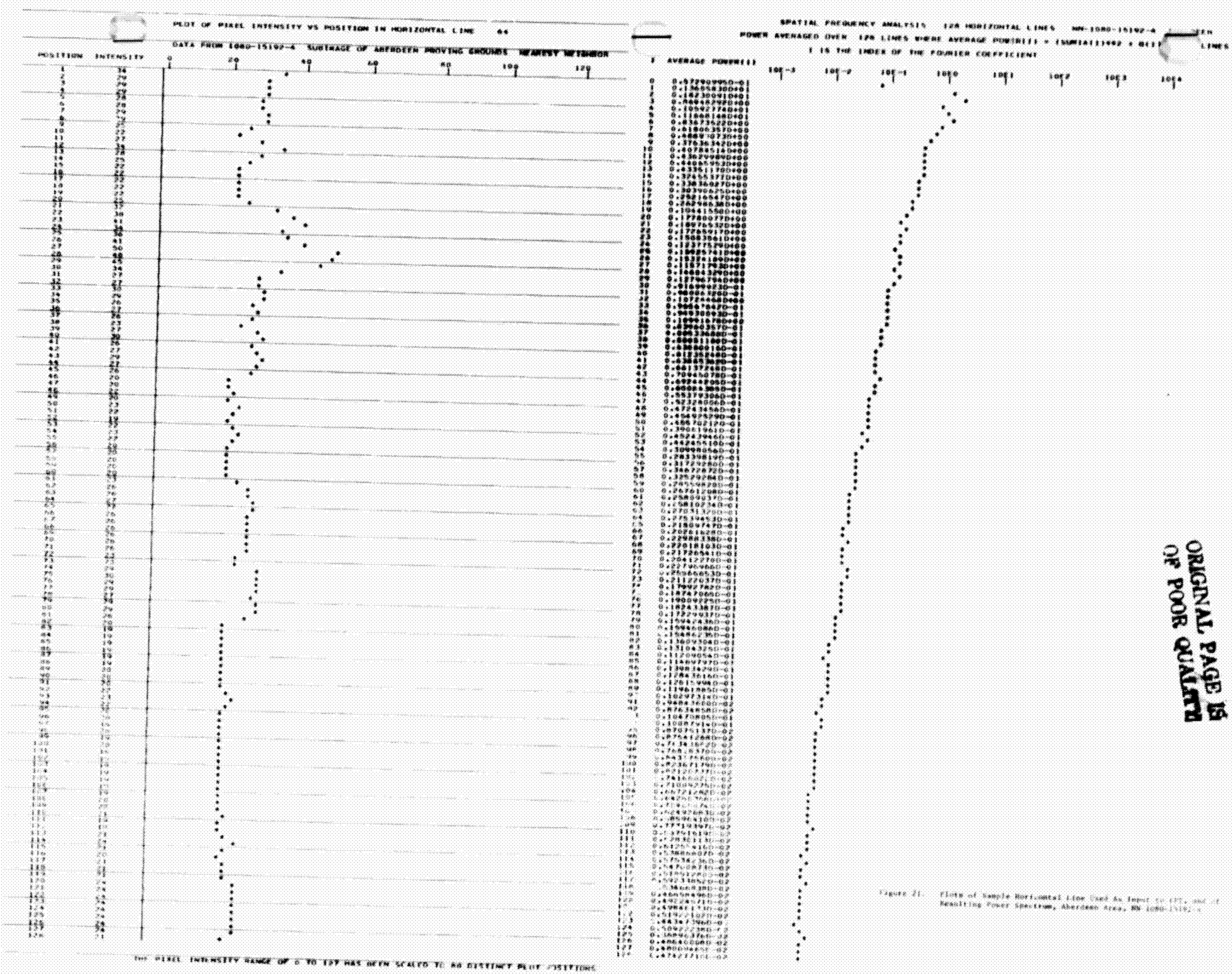


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Figure 21. Plots of Sample Horizontal Line Used As Input to FFT, and of Resulting Power Spectrum, Aberdeen Area, NN 1080-15192-4

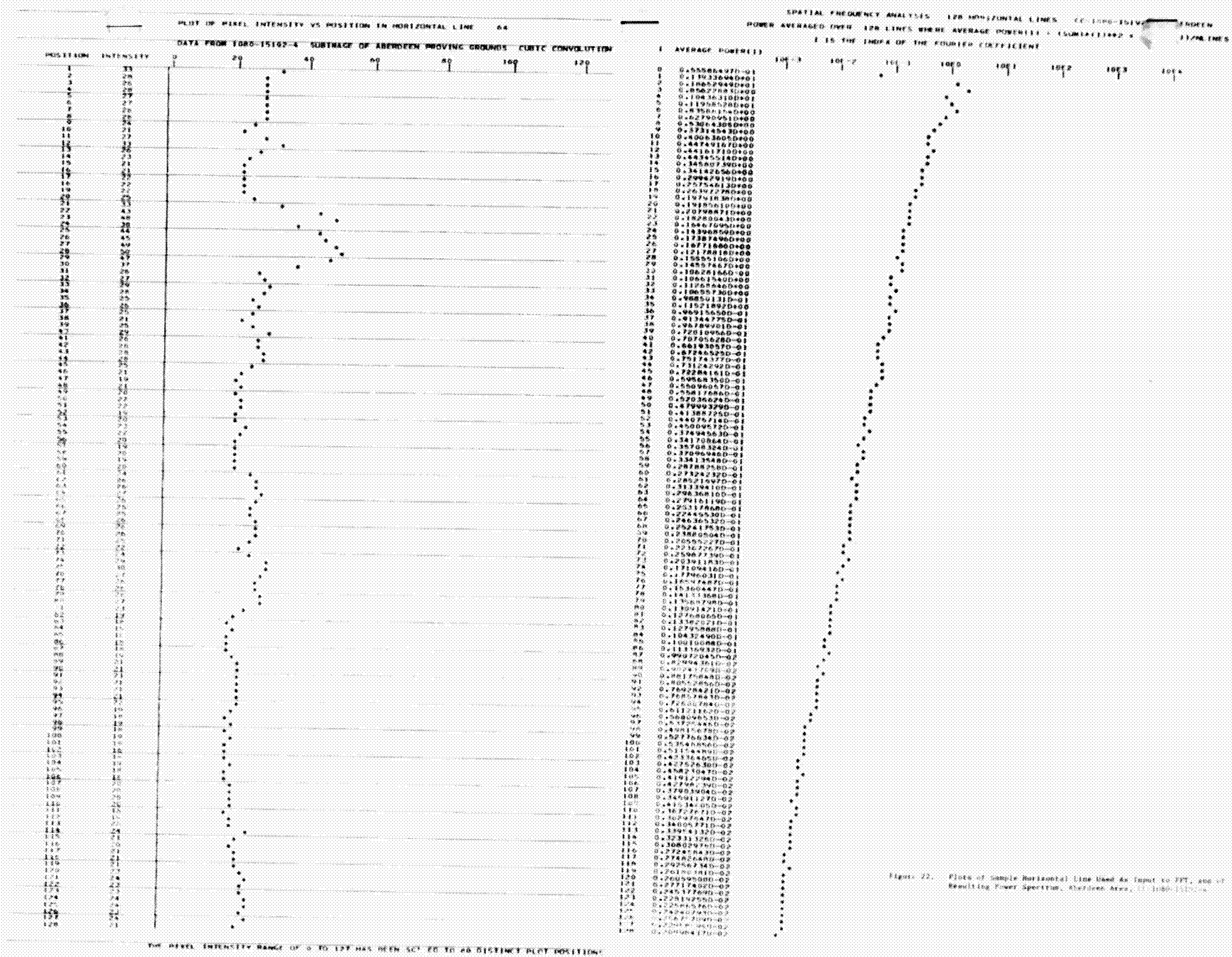
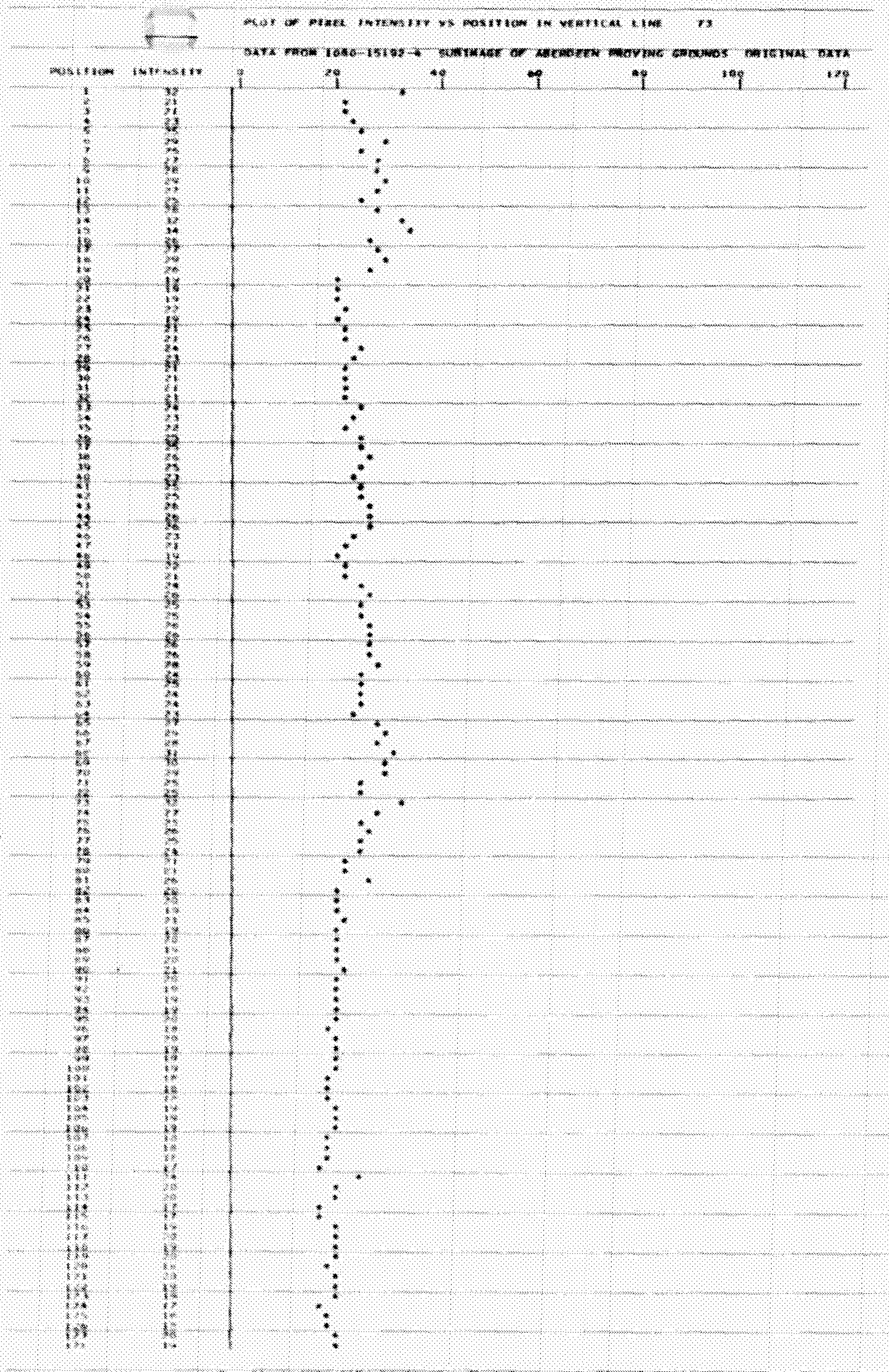


Figure 22. Plots of Sample Horizontal Line Used As Input to FFT, and of Resulting Power Spectrum, Aberdeen Area, [illegible]



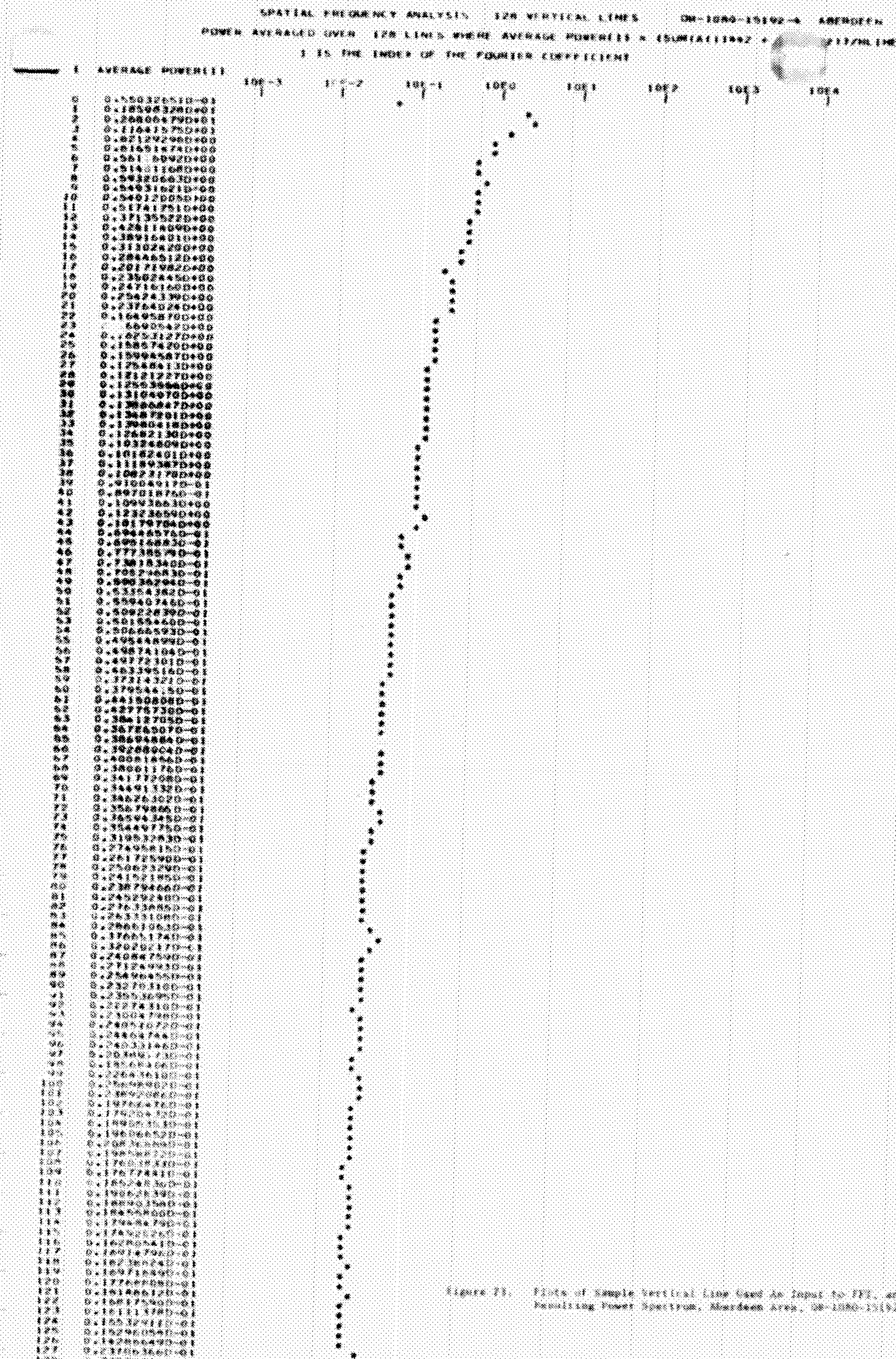
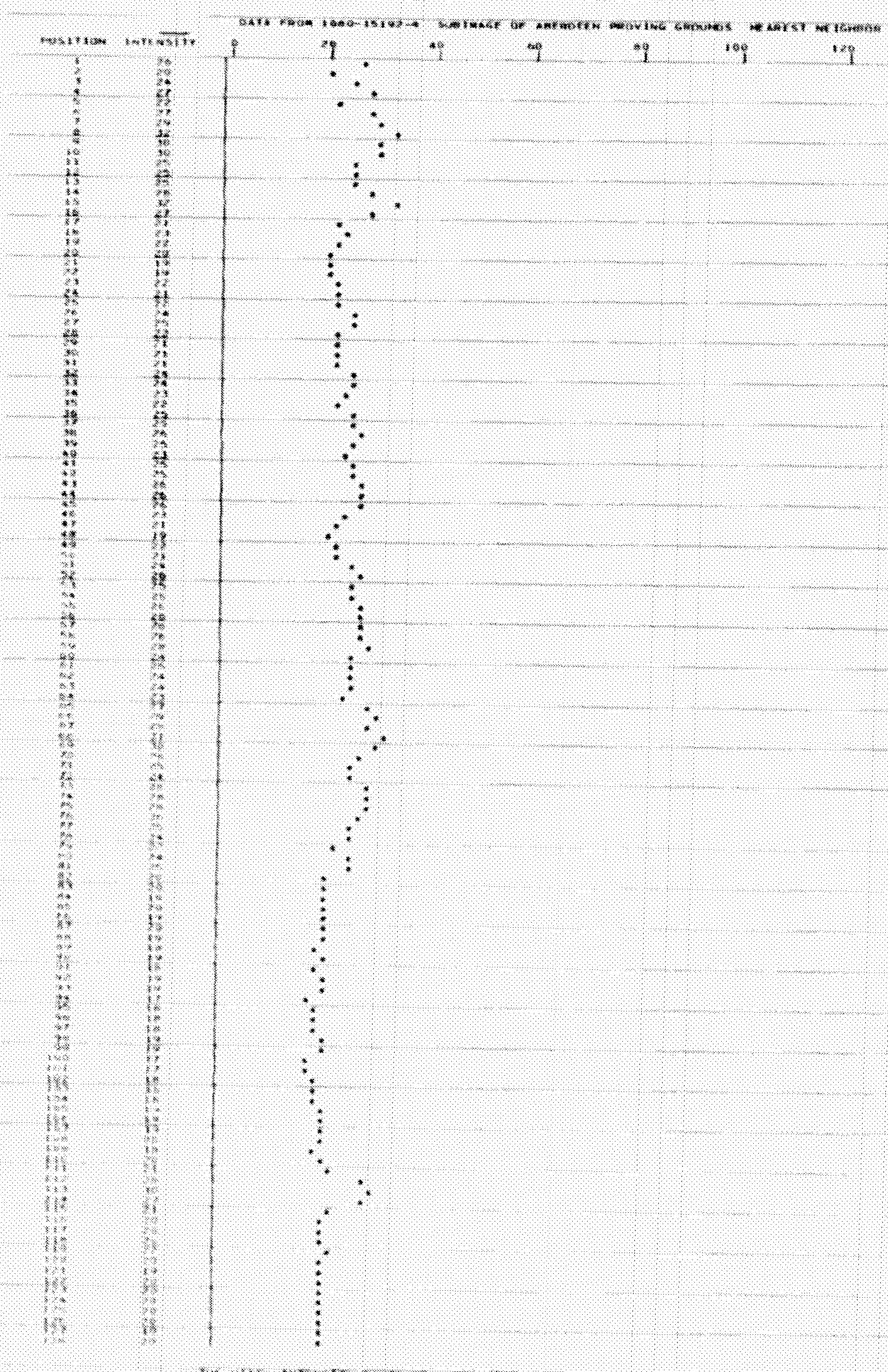


Figure 71. Plots of Sample Vertical Line Used As Input to FFT, and of Resulting Power Spectrum, Aberdeen Area, GN-1080-15192-4



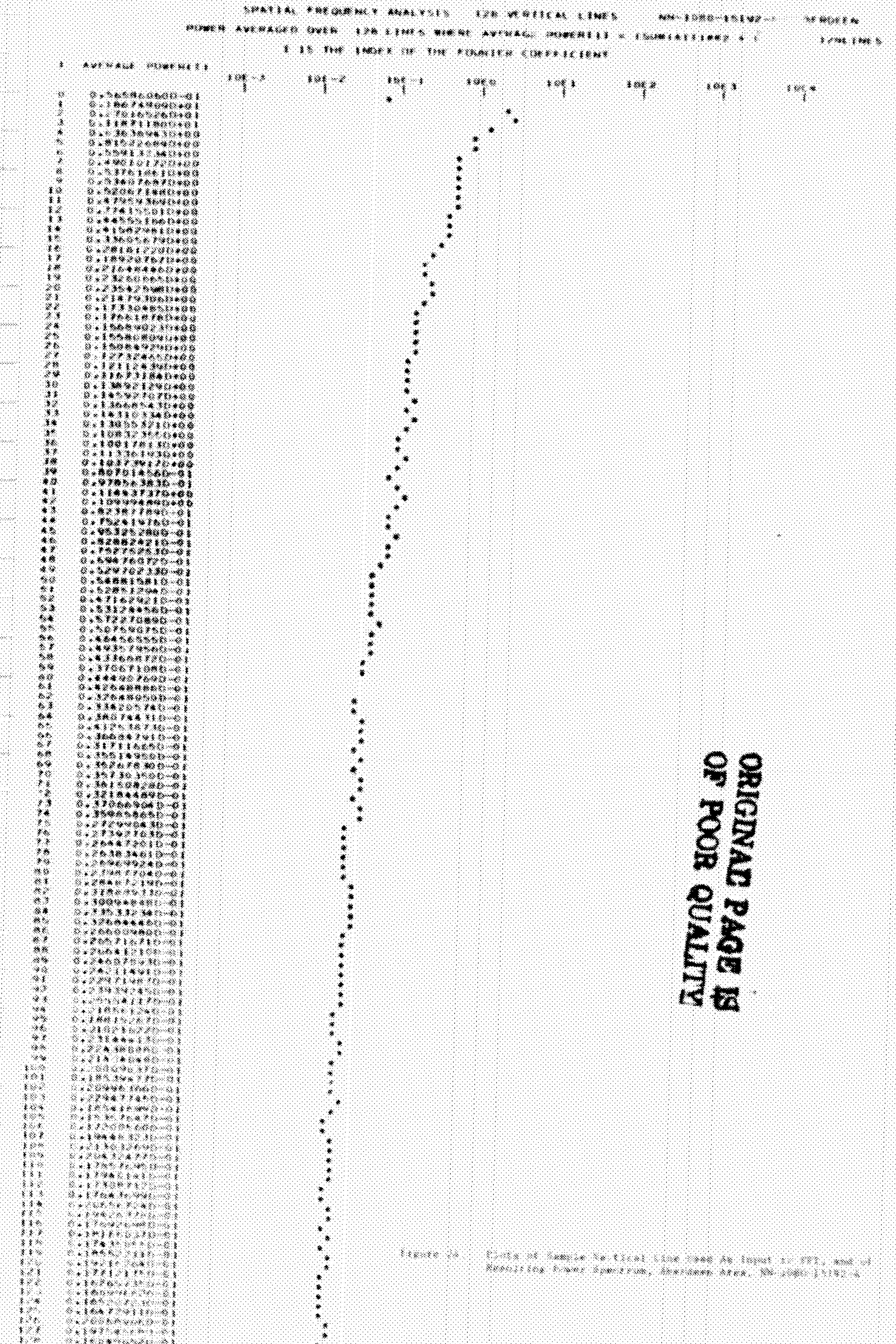
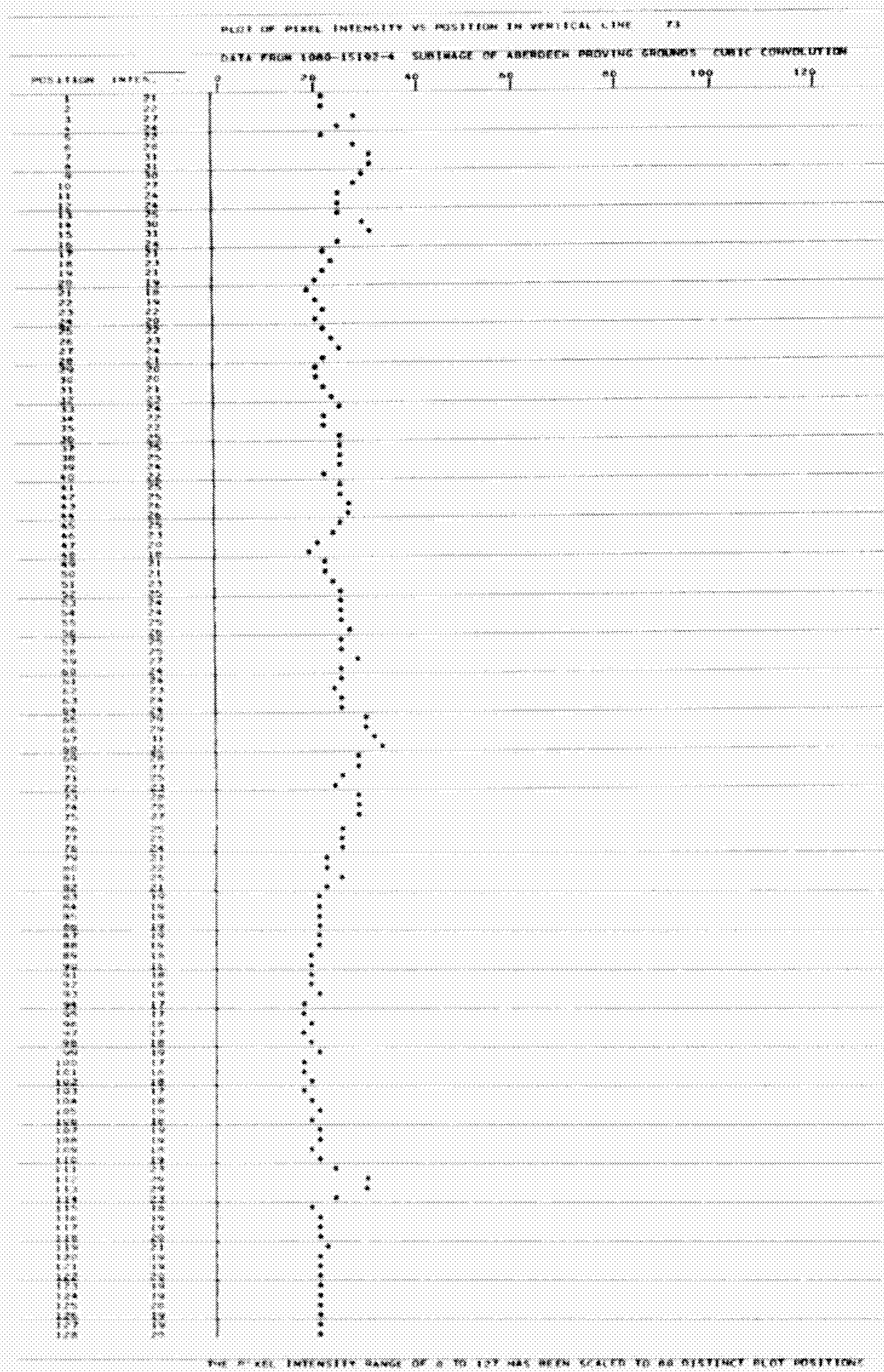


Figure [illegible]. Plots of Sample Vertical Line Used As Input to FFT, and of Resulting Power Spectrum, Aberdeen Area, NN-1080-15192-4



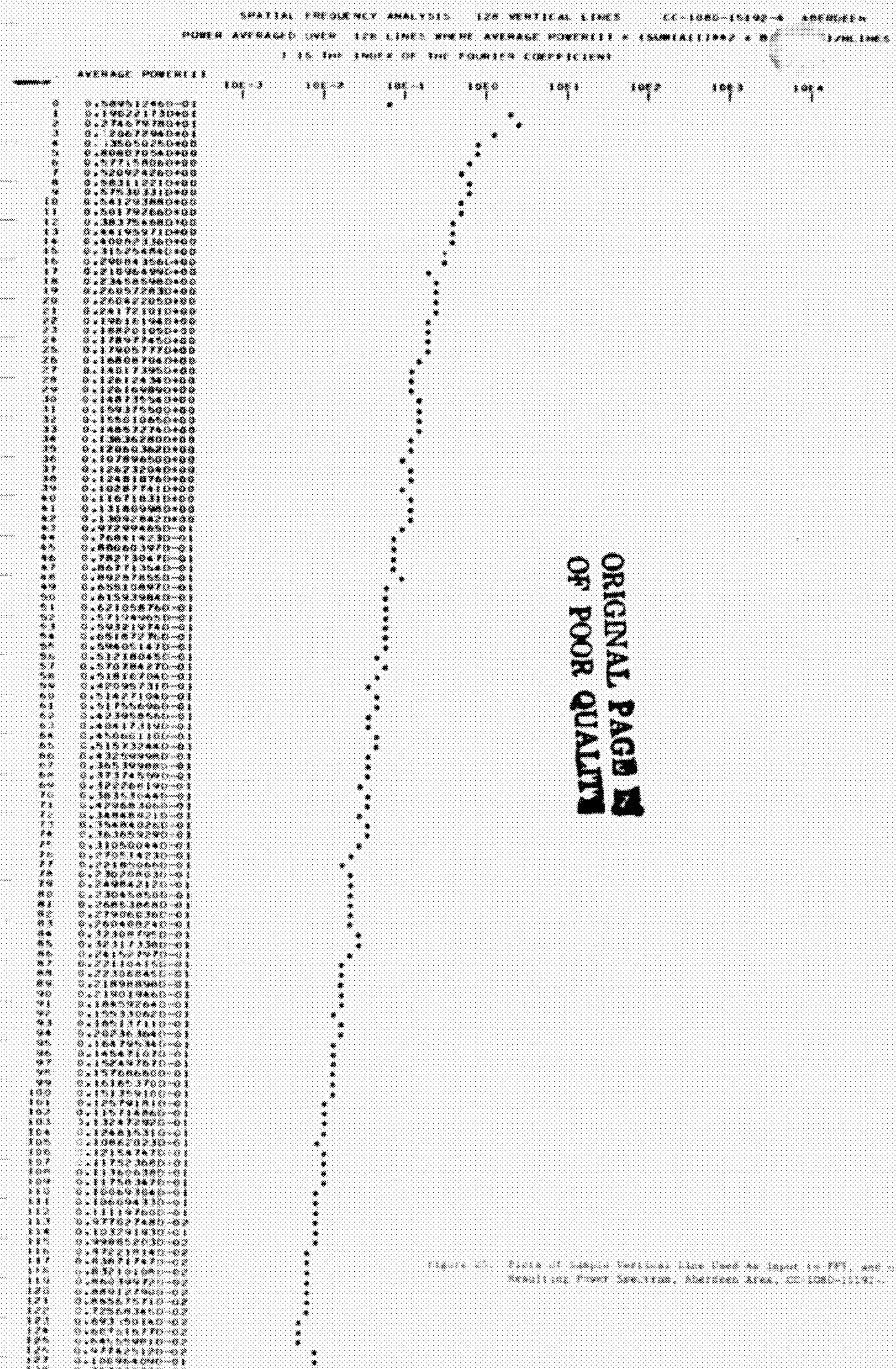


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Figure 25. Plots of Sample Vertical Line Used As Input to FFT, and of Resulting Power Spectrum, Aberdeen Area, CC-1080-15192-4.

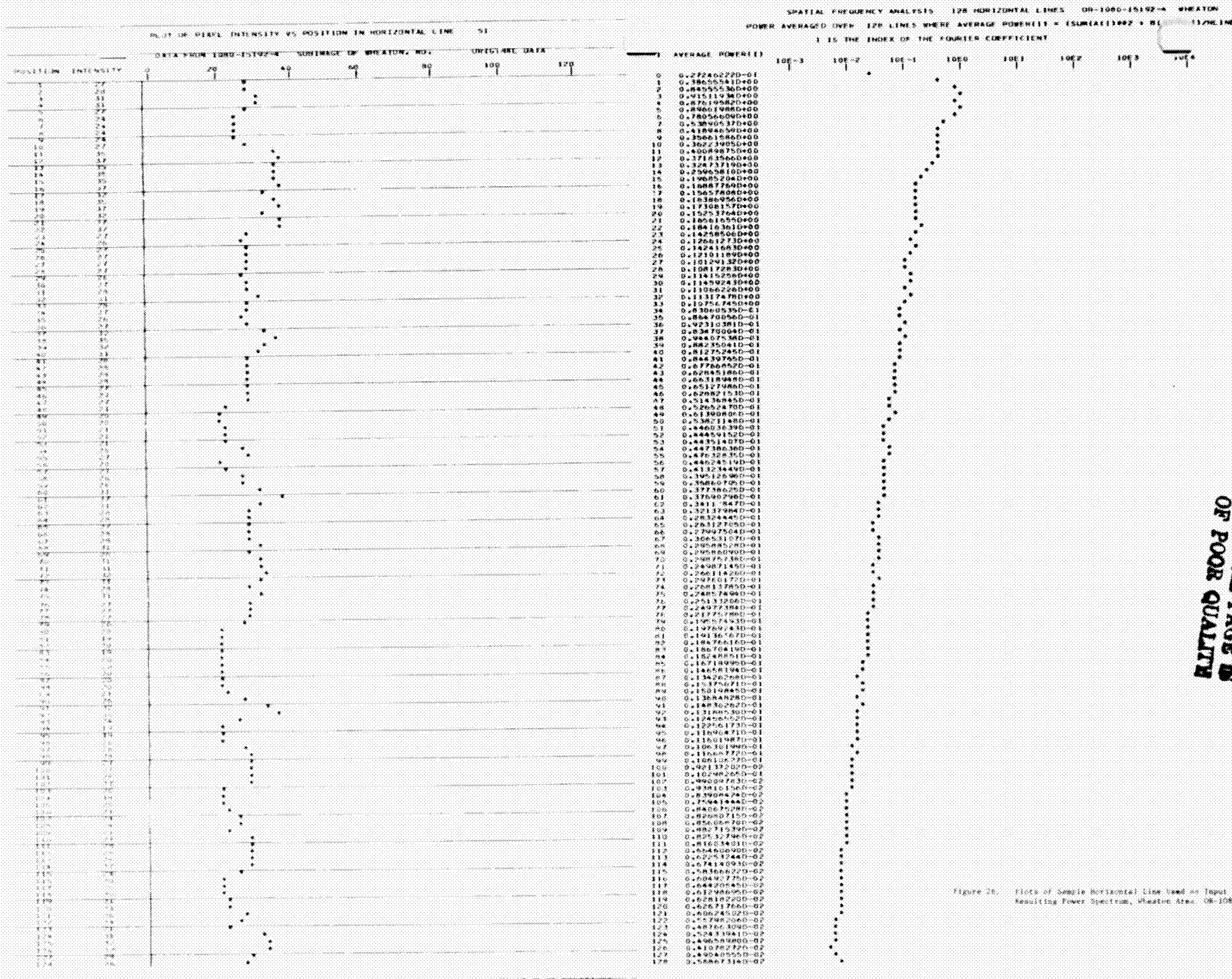

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Figure 26. Plots of Sample Horizontal Line Used as Input to FFT, and of Resulting Power Spectrum, Wheaton Area. OR-1080-15192-4

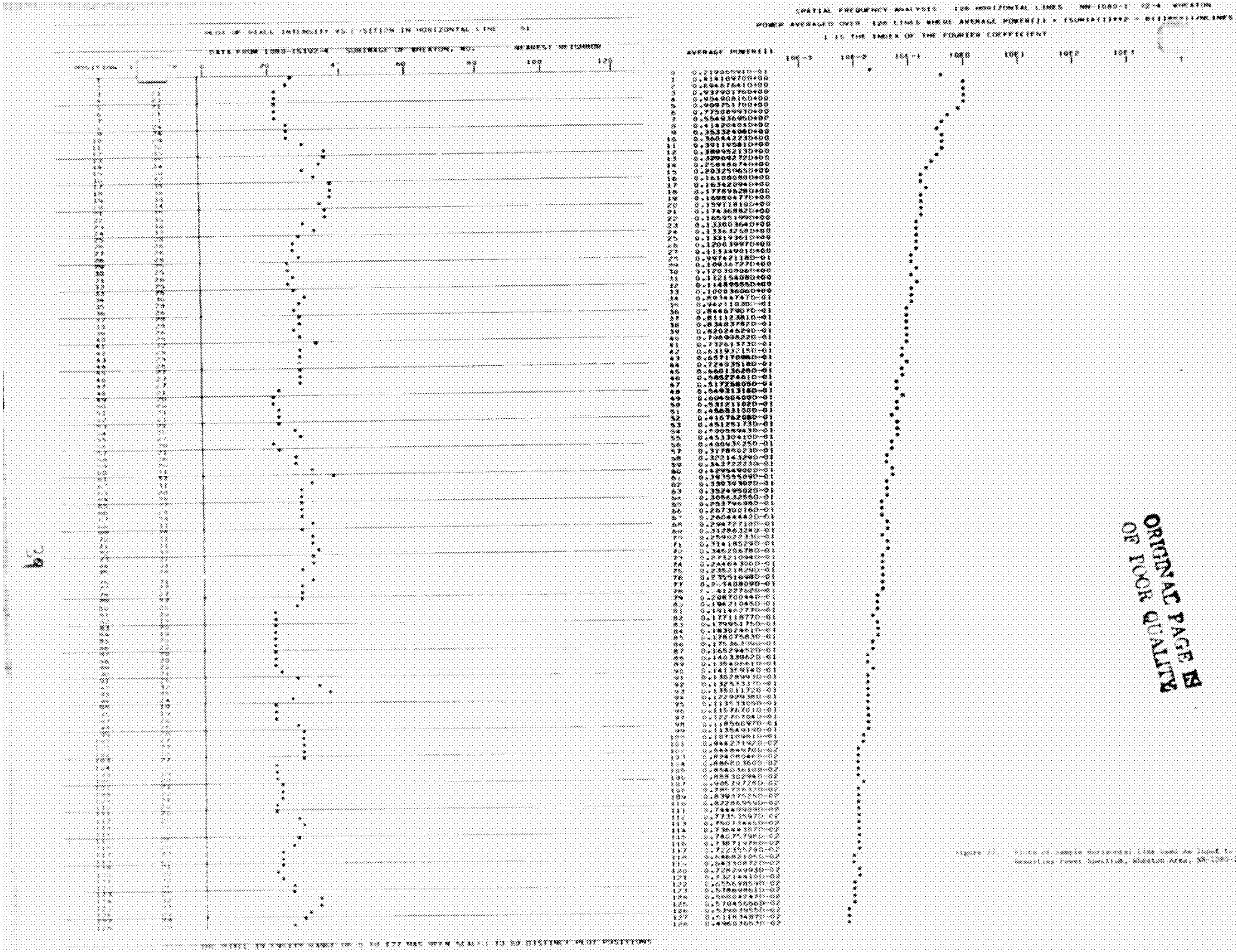


Figure 17. Plots of Sample Horizontal Line Used As Input to FFT, and of Resulting Power Spectrum, Wheaton Area, NN-1080-15192-4

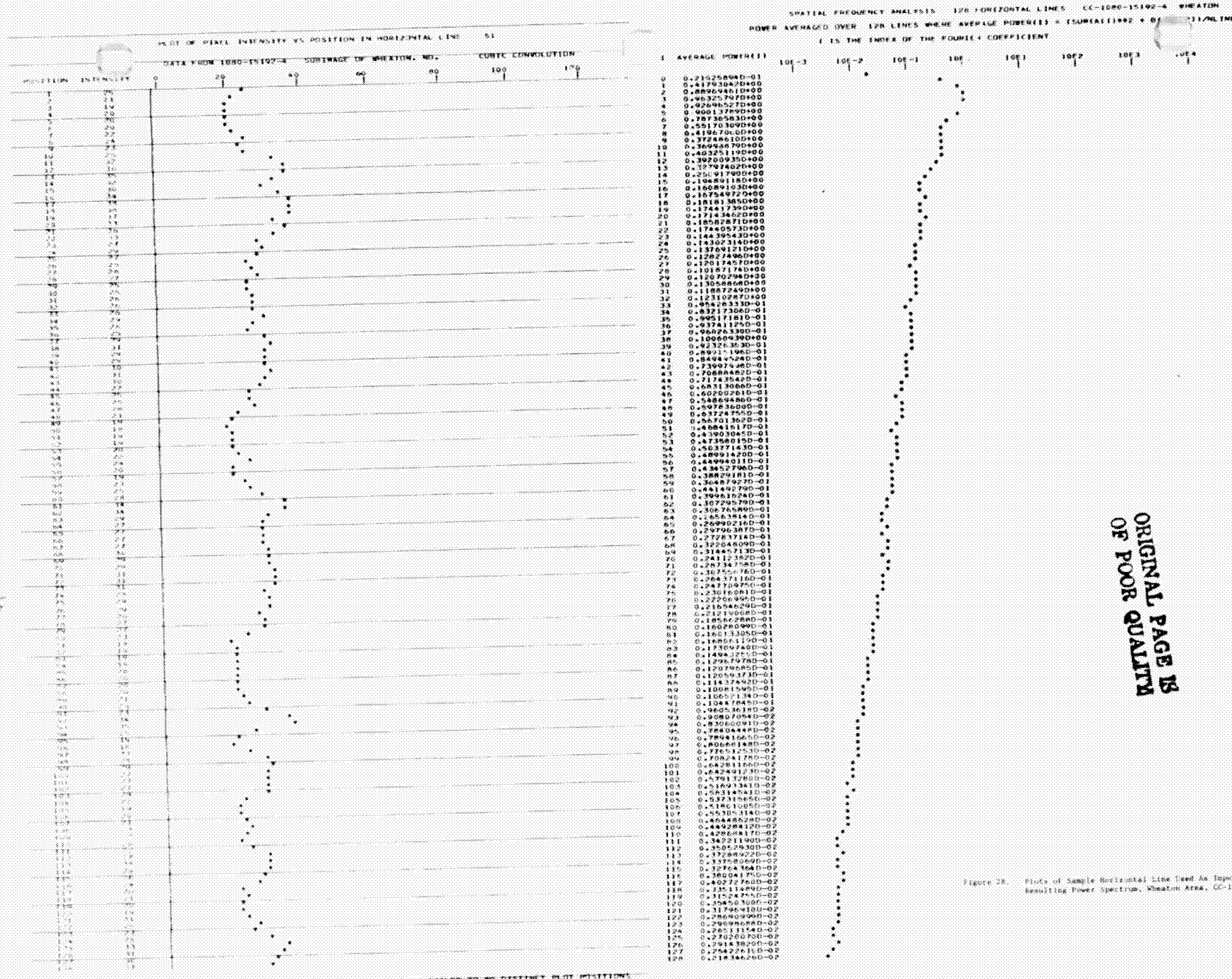
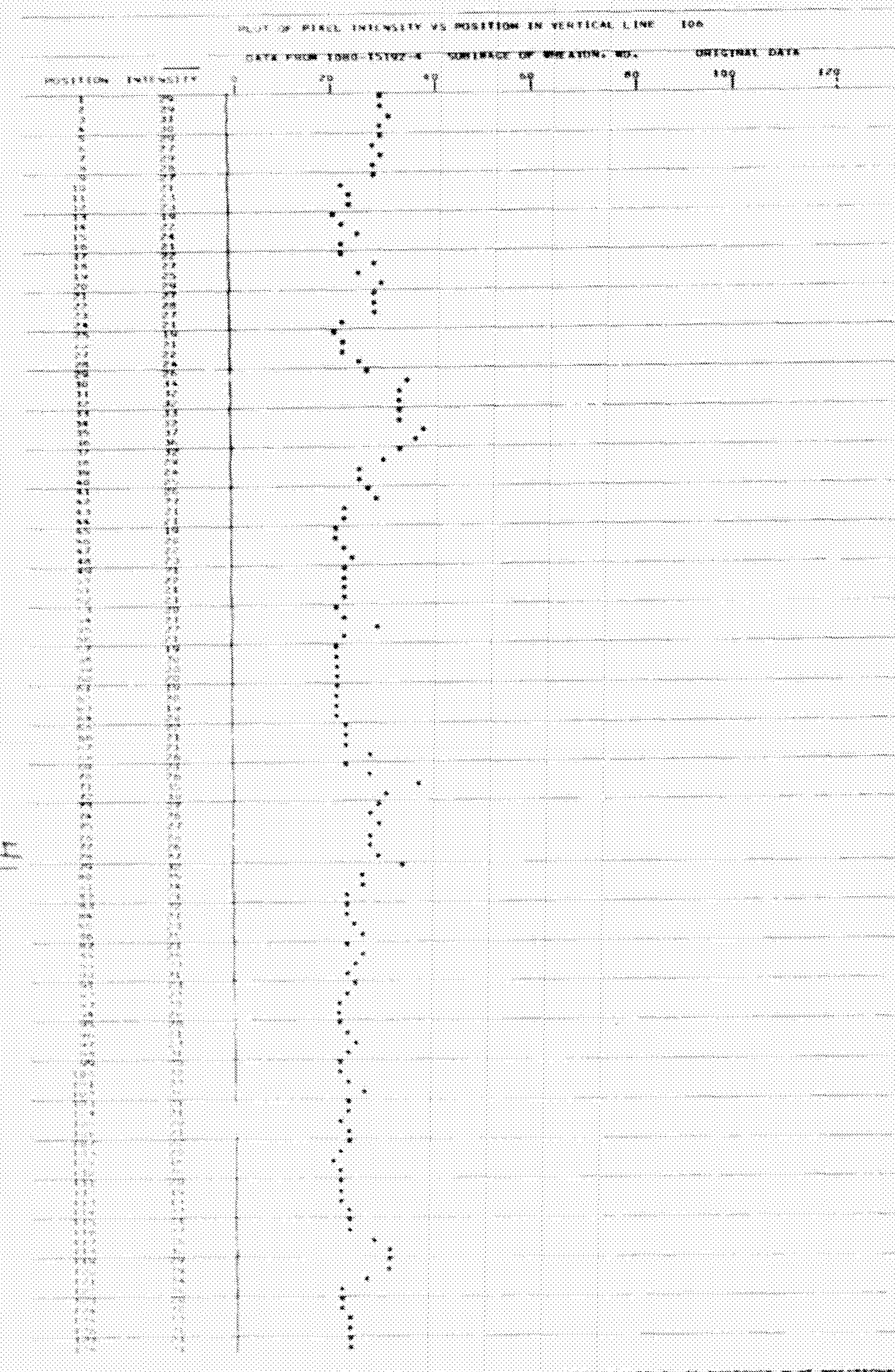


Figure 28. Plots of Sample Horizontal Line Used As Input to FFT, and of Resulting Power Spectrum, Wheaton Area, CC-1080-15192-4



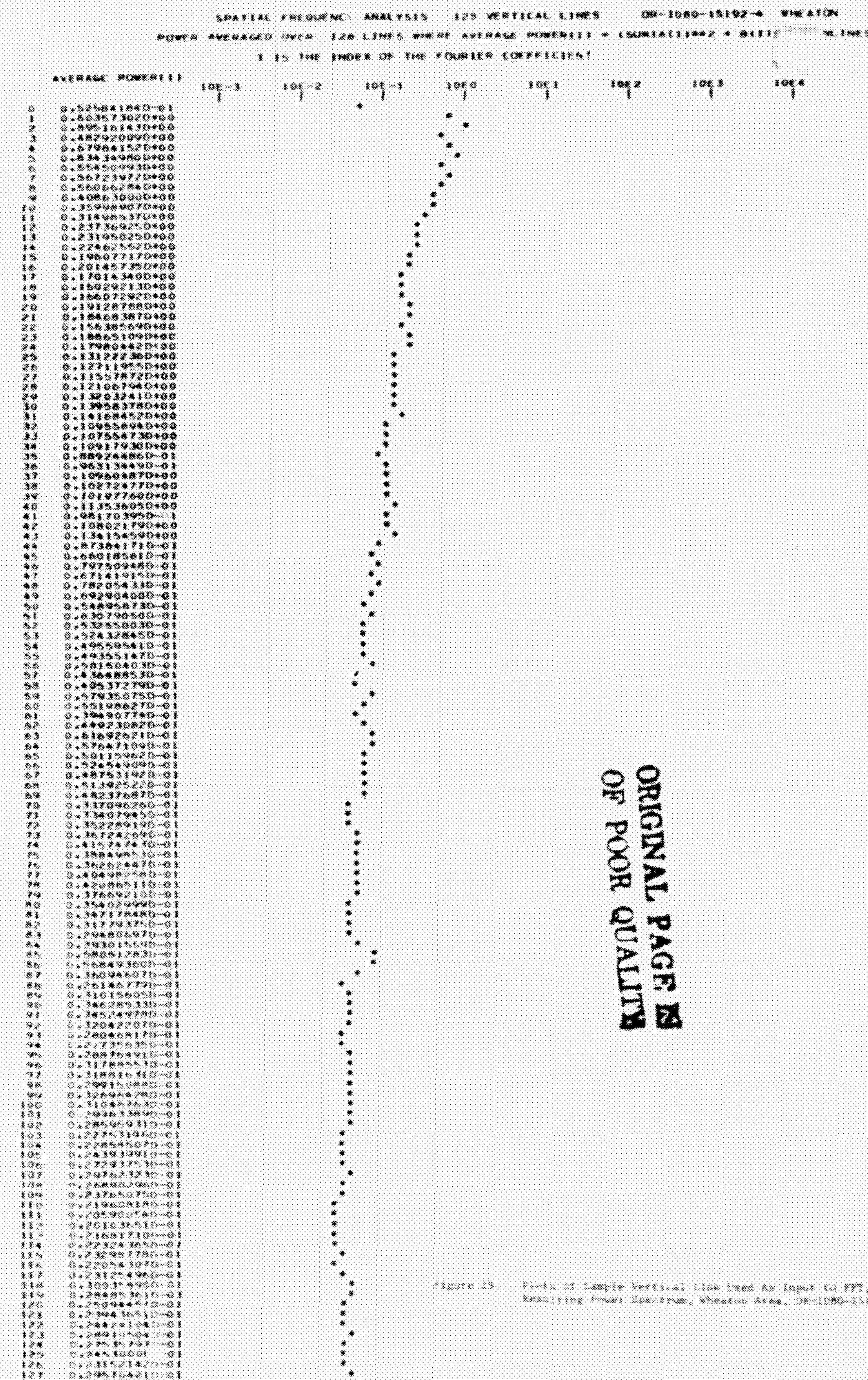


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Figure 23. Plots of Sample Vertical Line Used As Input to FFT, and of Resulting Power Spectrum, Wheaton Area, DR-1080-15192-4

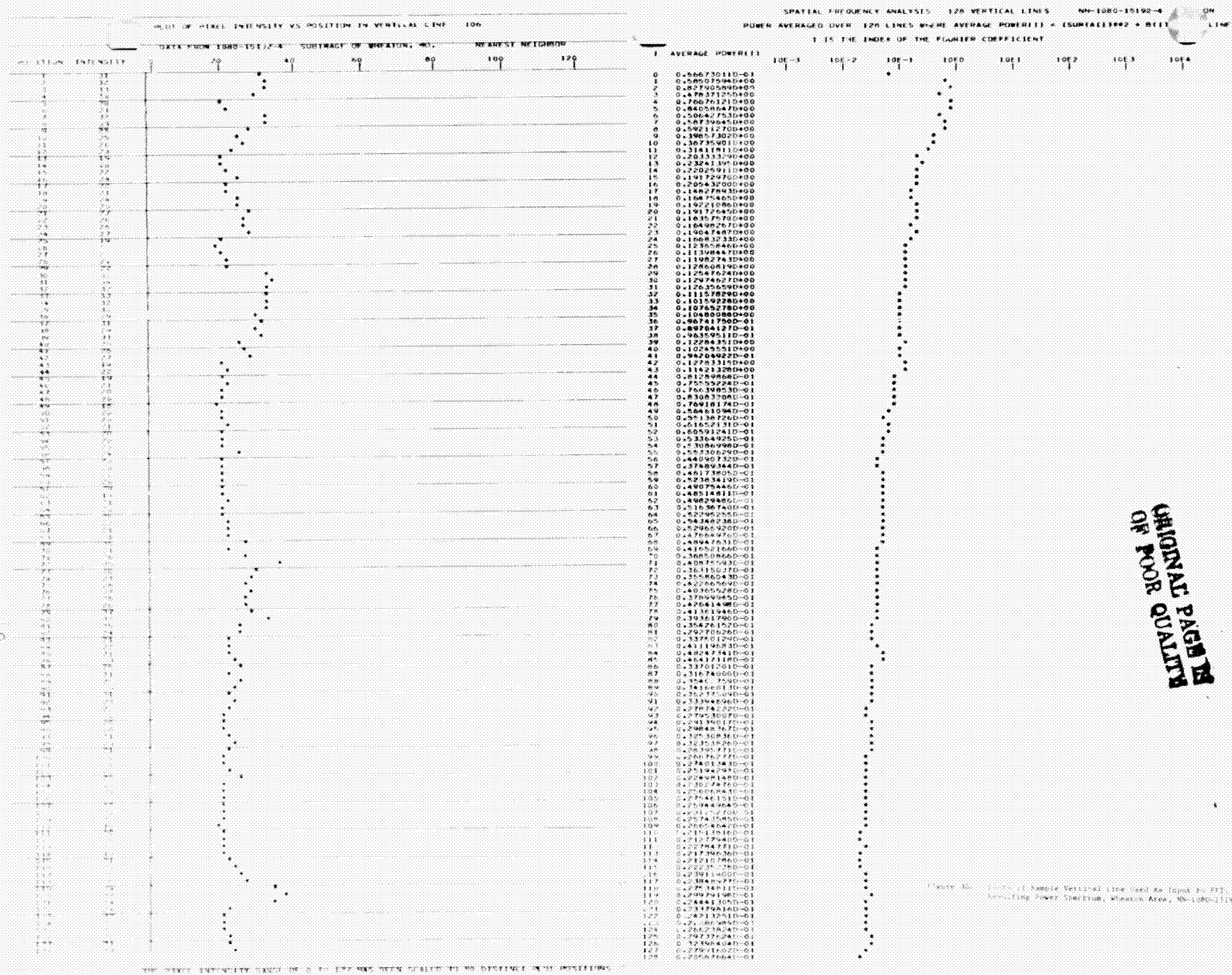


Figure 30. Plot of Sample Vertical Line Used As Input to FFT, and of Resulting Power Spectrum, Wheaton Area, NN-1080-15192-4

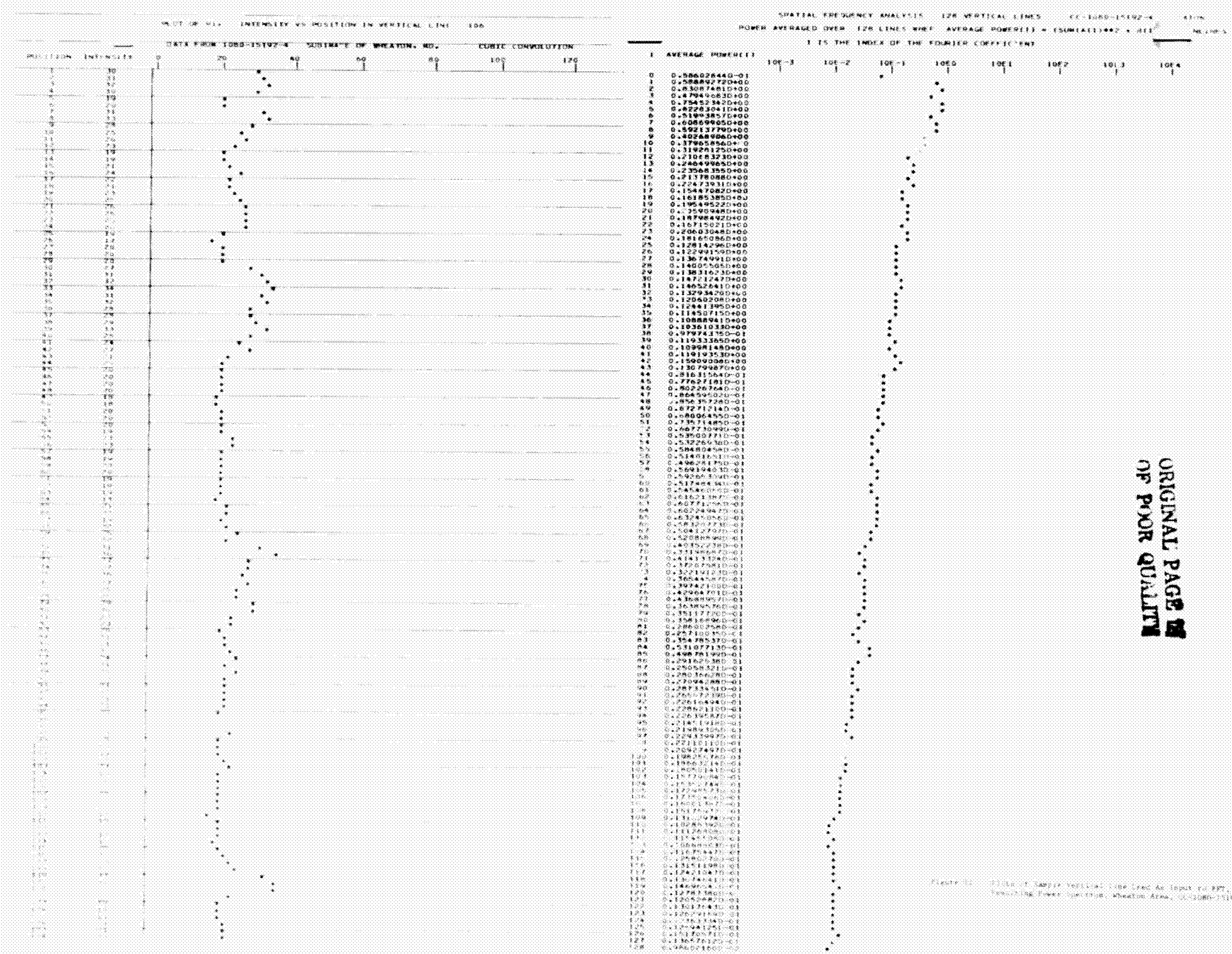
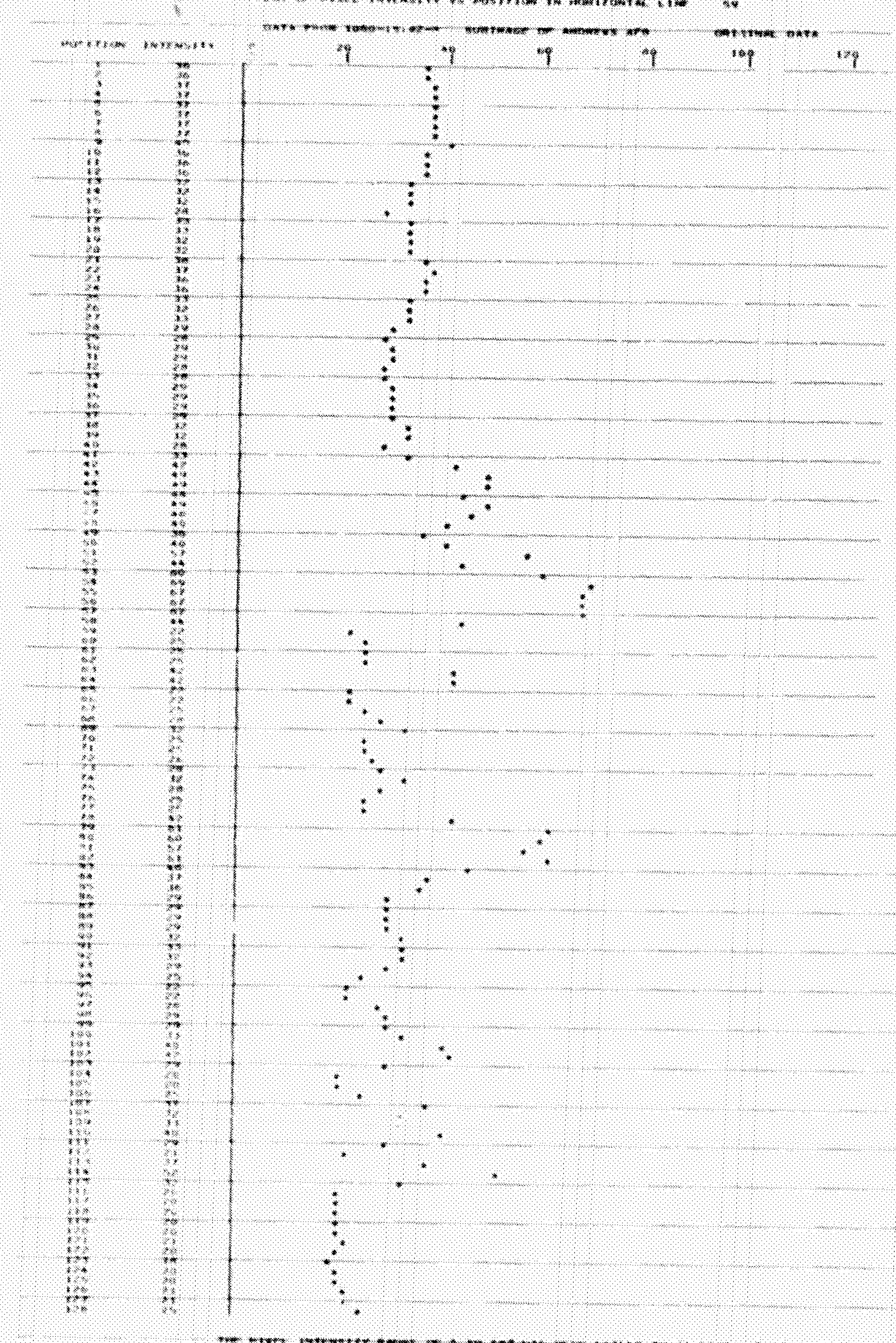


Figure [illegible]. Plots of Sample Vertical Line Used As Input to FFT, and of Resulting Power Spectrum, Wheaton Area, CC-1080-15192-4



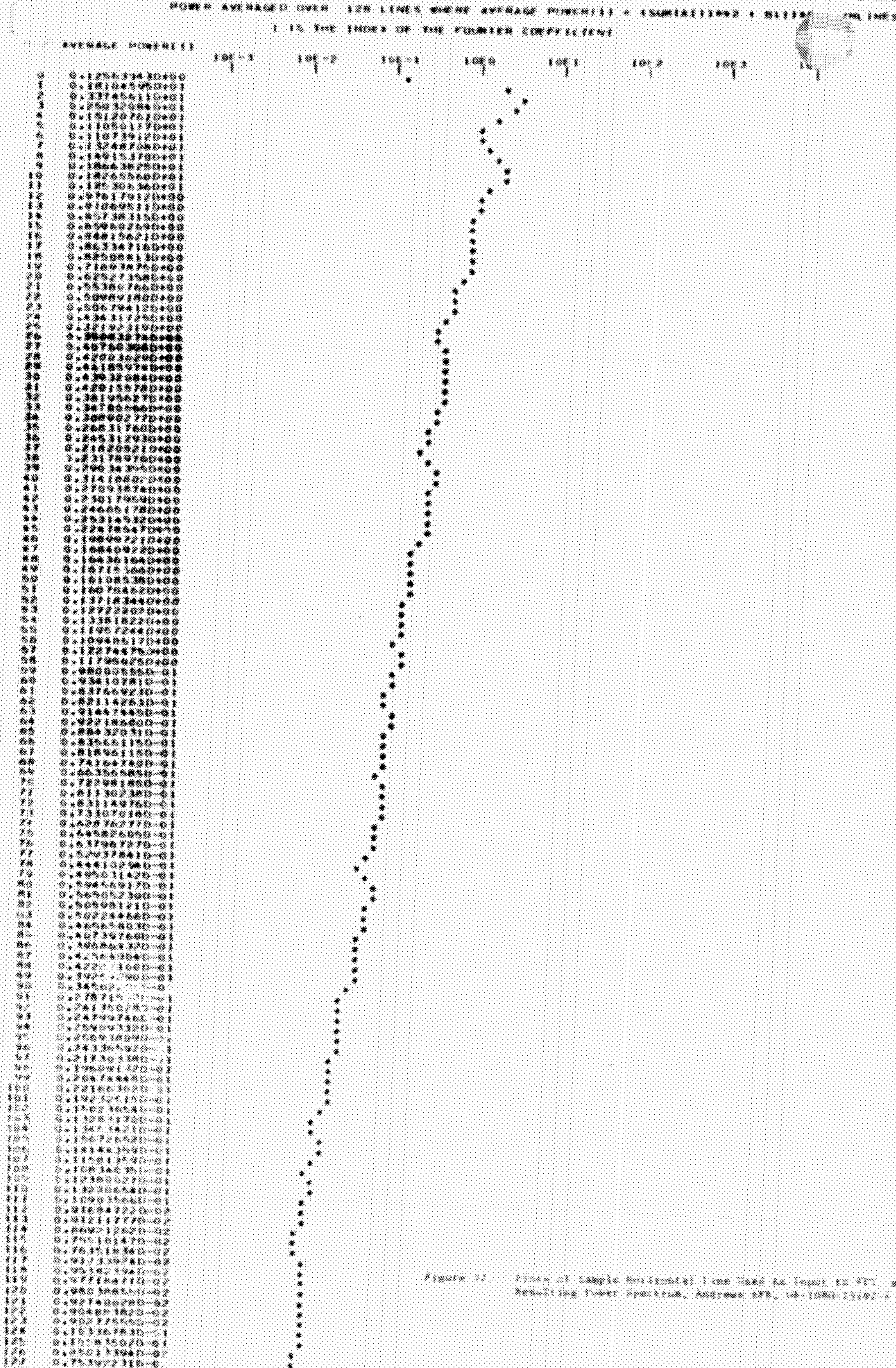
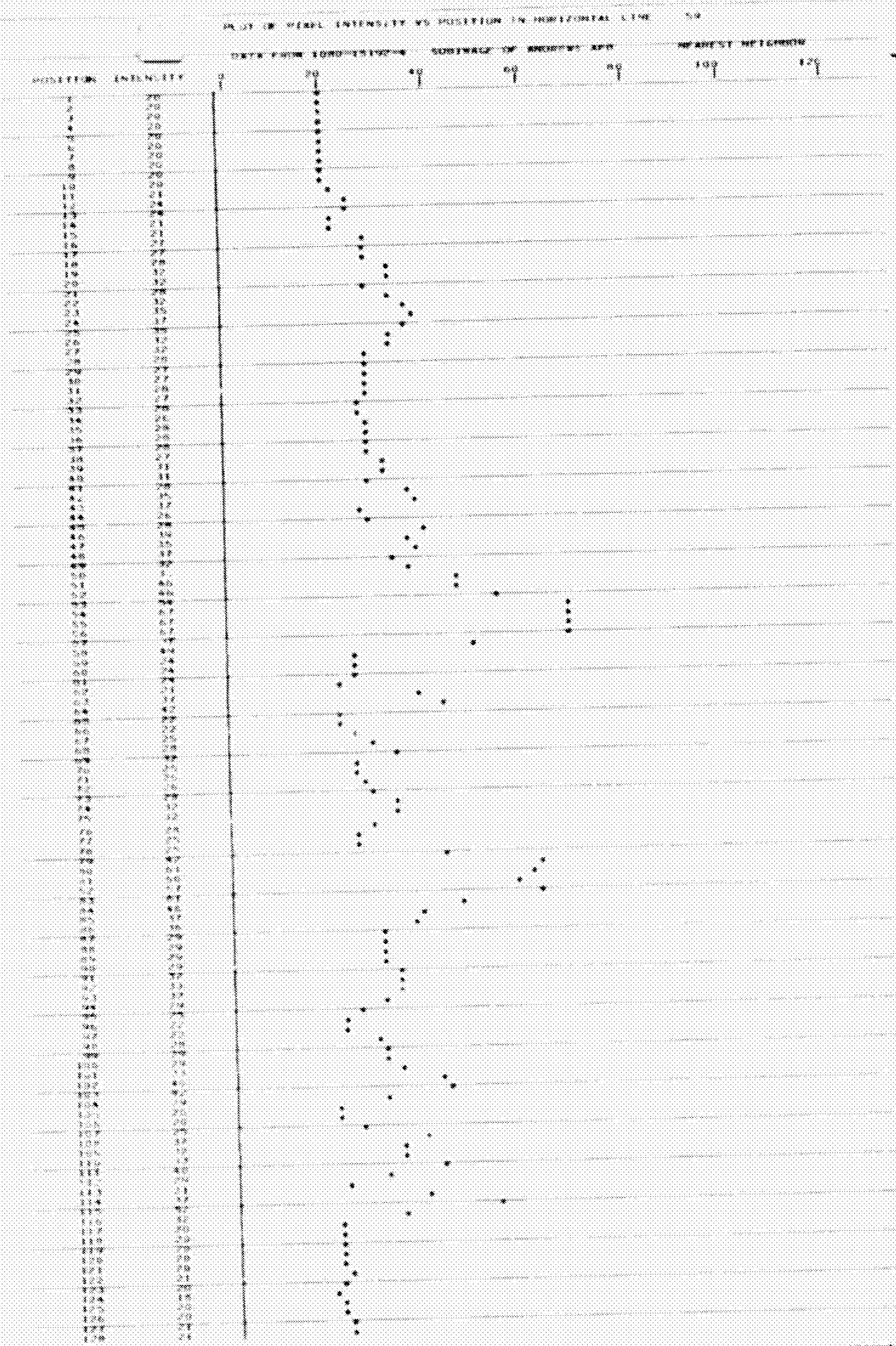


Figure 17. Plots of Sample Horizontal Line Used As Input to FFT, and of Resulting Power Spectrum, Andrews AFB, GK-1080-15192-4



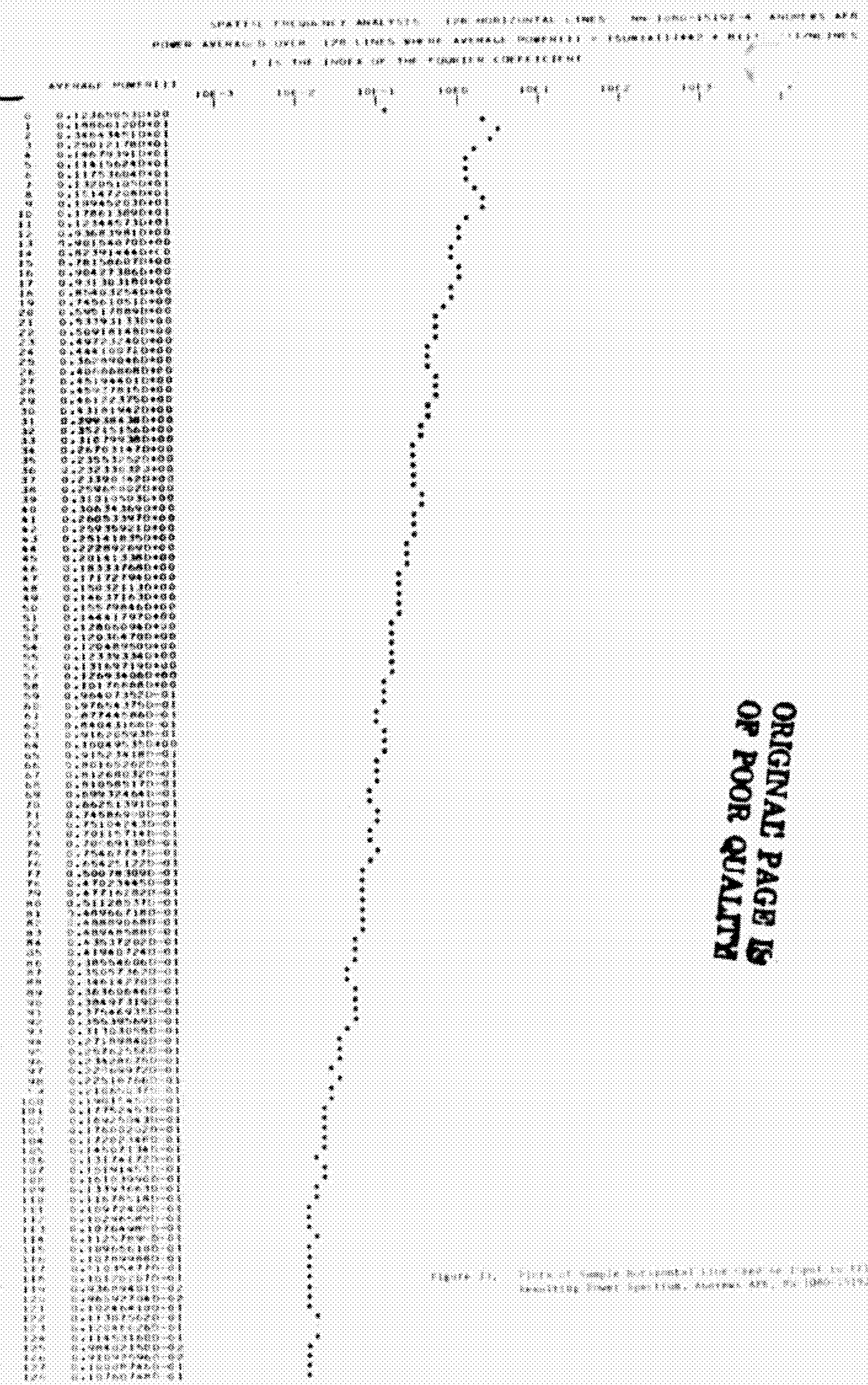
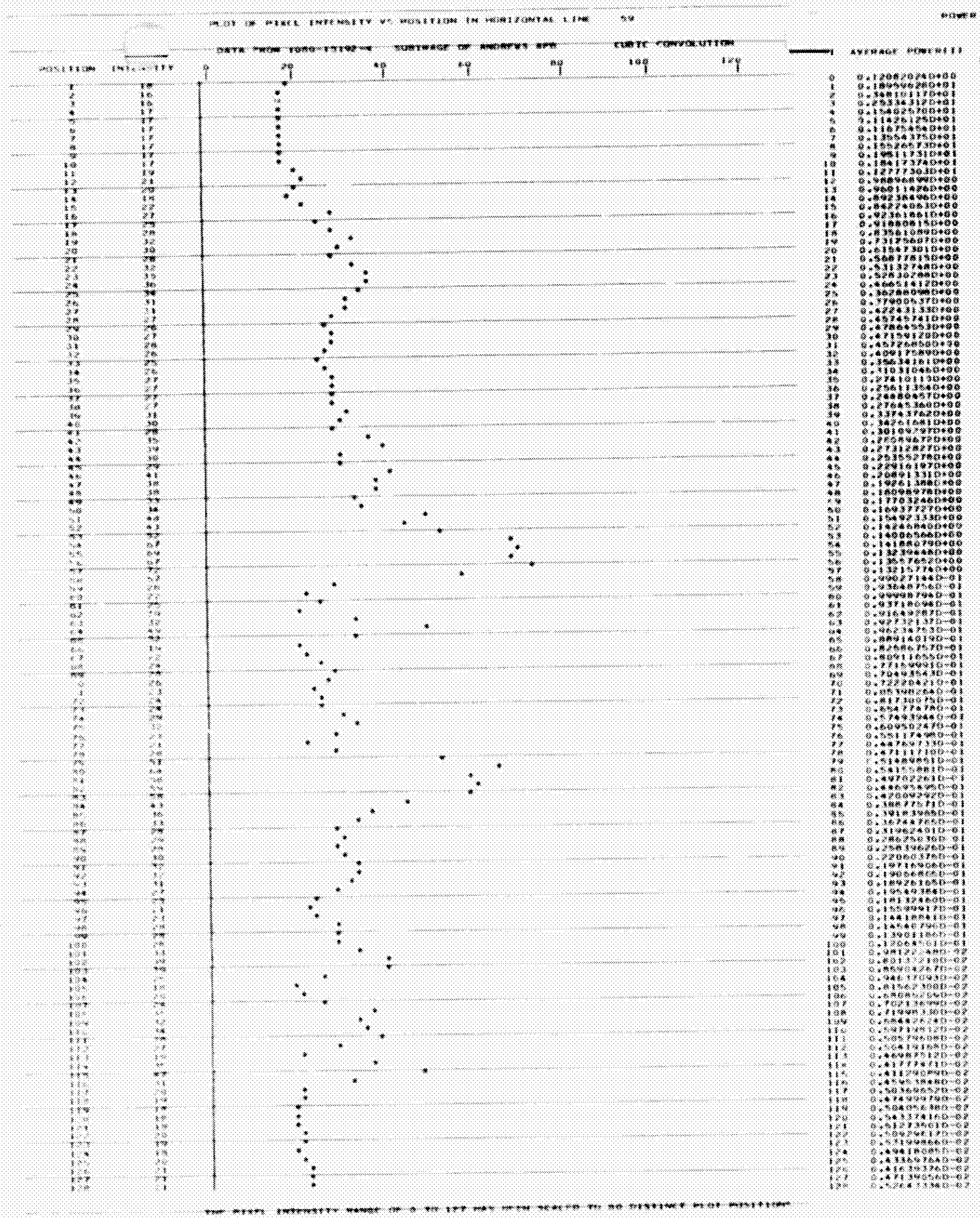


Figure 11. Plots of Sample Horizontal Line Used as Input to FFT, and of Resulting Power Spectrum, Andrews AFB, NN 1080-15192-4



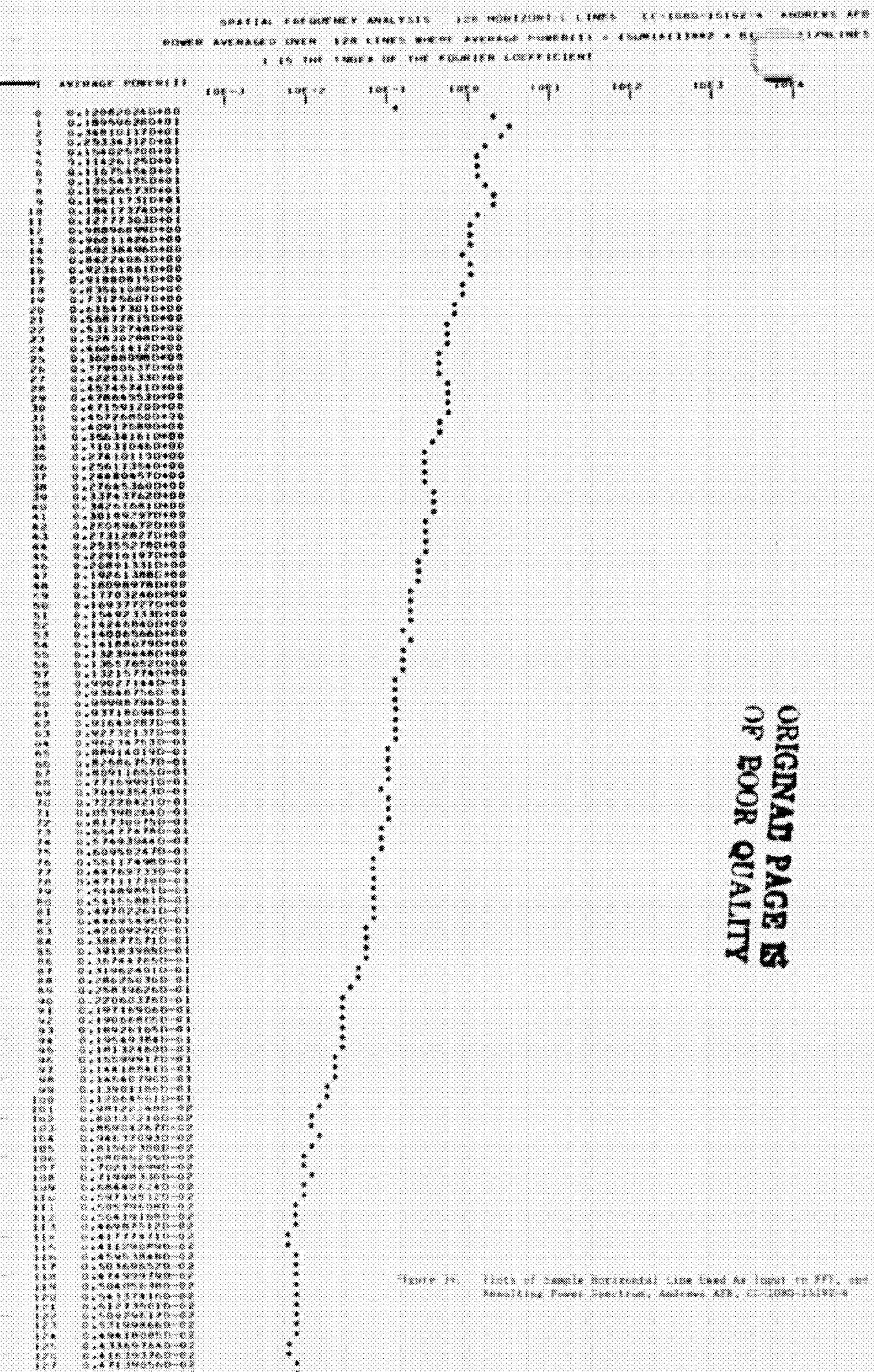


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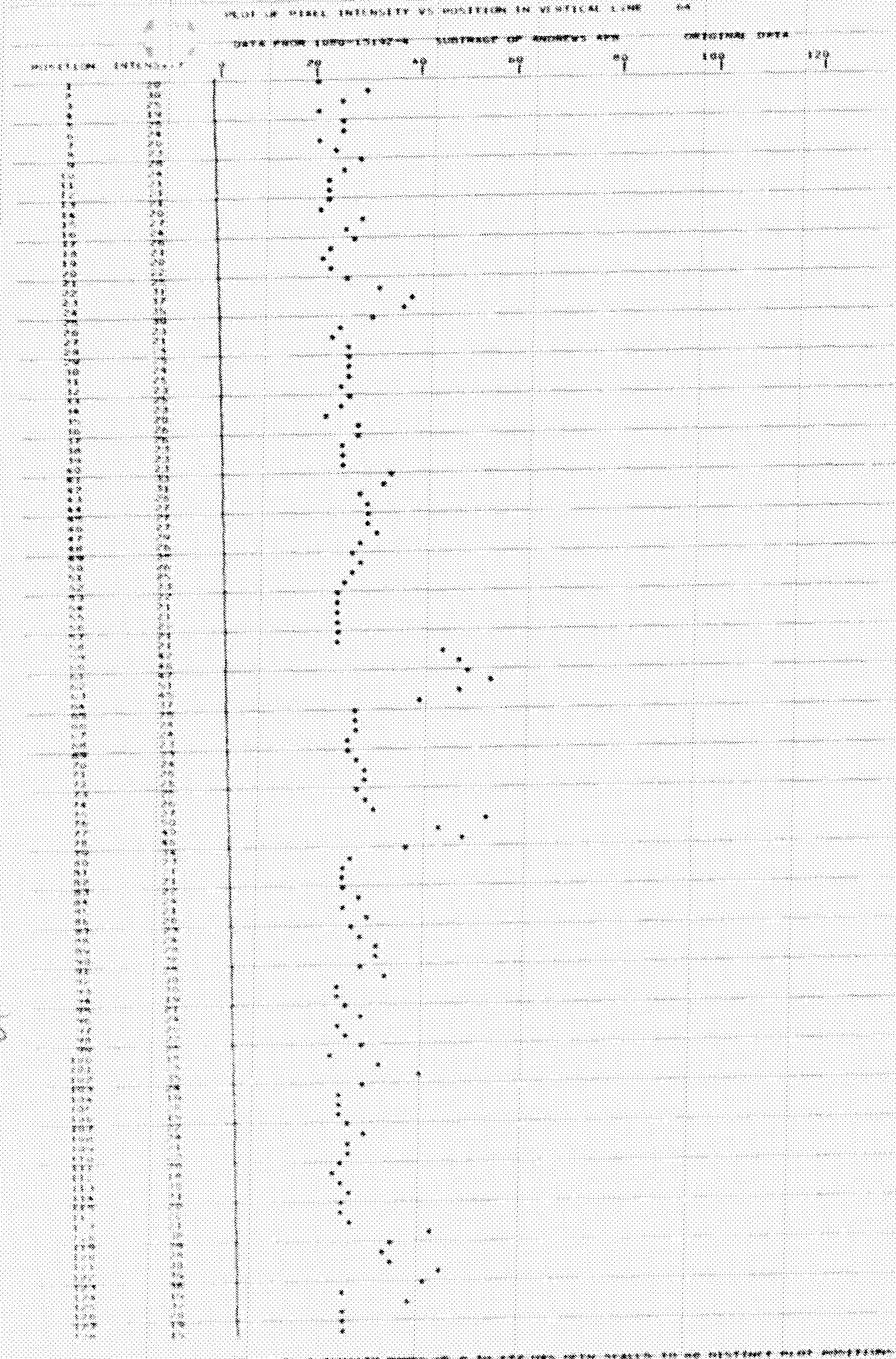
Figure 14. Plots of Sample Horizontal Line Used As Input to FFT, and of Resulting Power Spectrum, Andrews AFB, CC-1080-15192-6



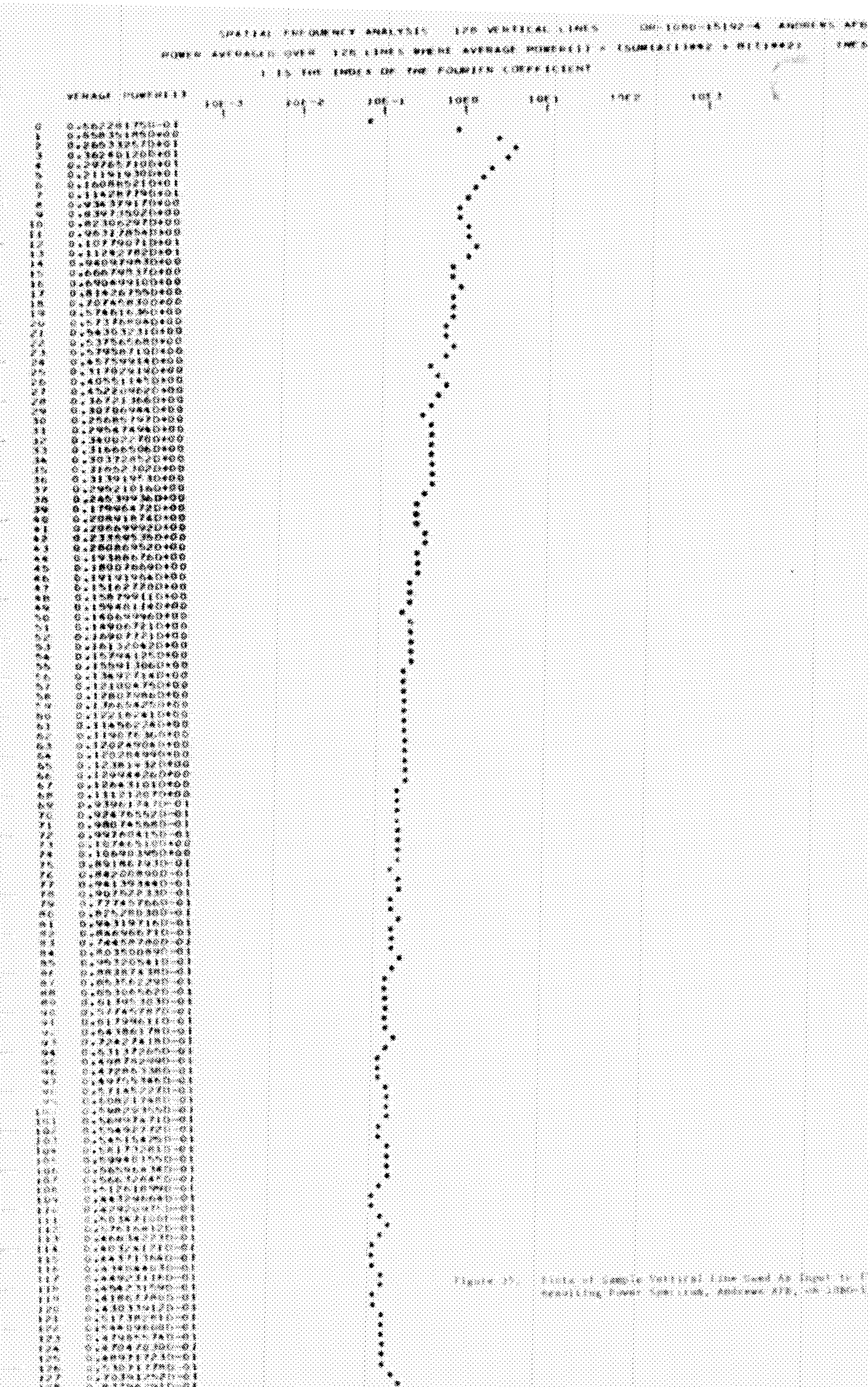
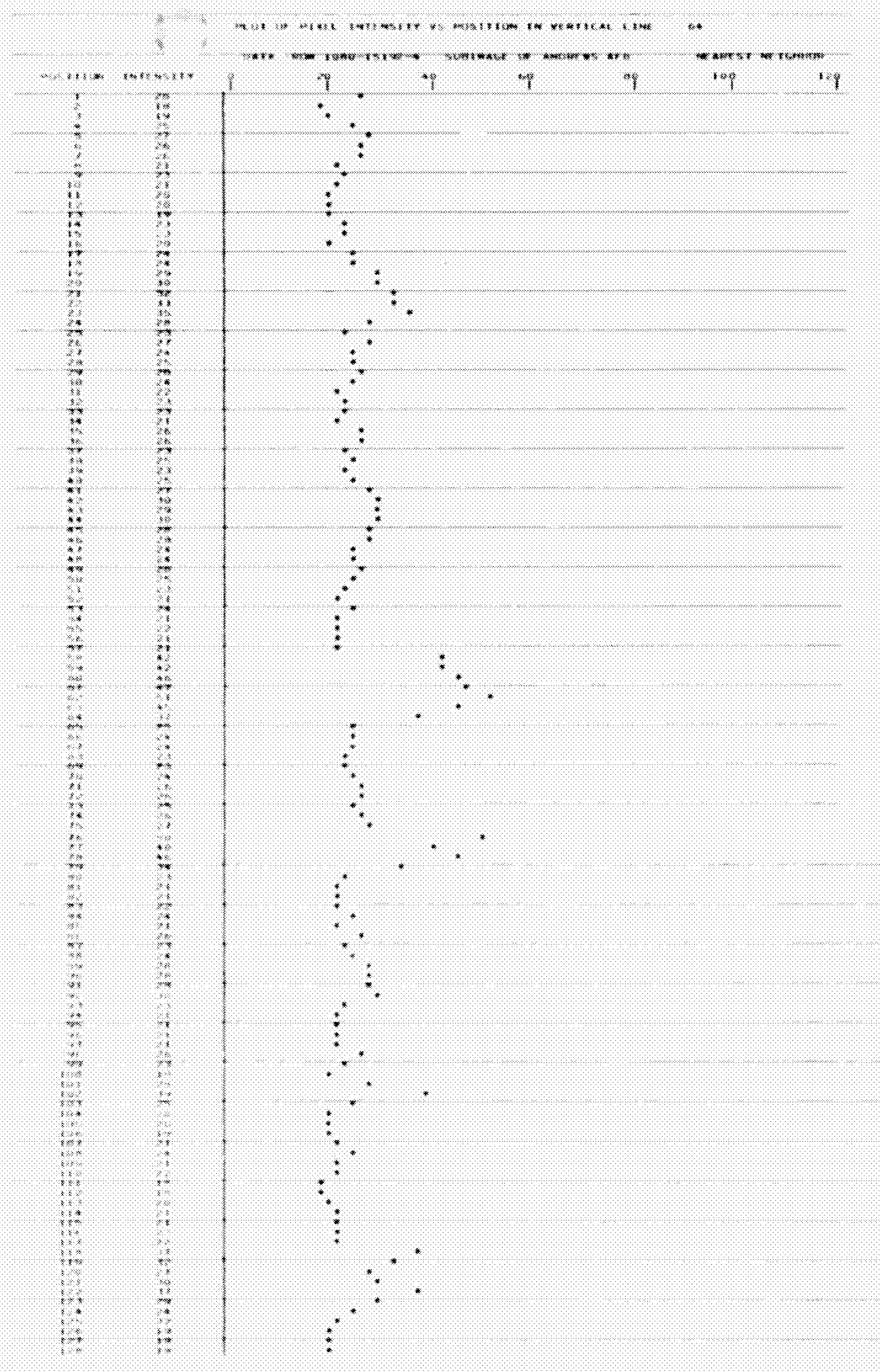


Figure 25. Plots of Sample Vertical Line Used As Input to FFT, and of Resulting Power Spectrum, Andrews AFB, OR-1080-15192-4



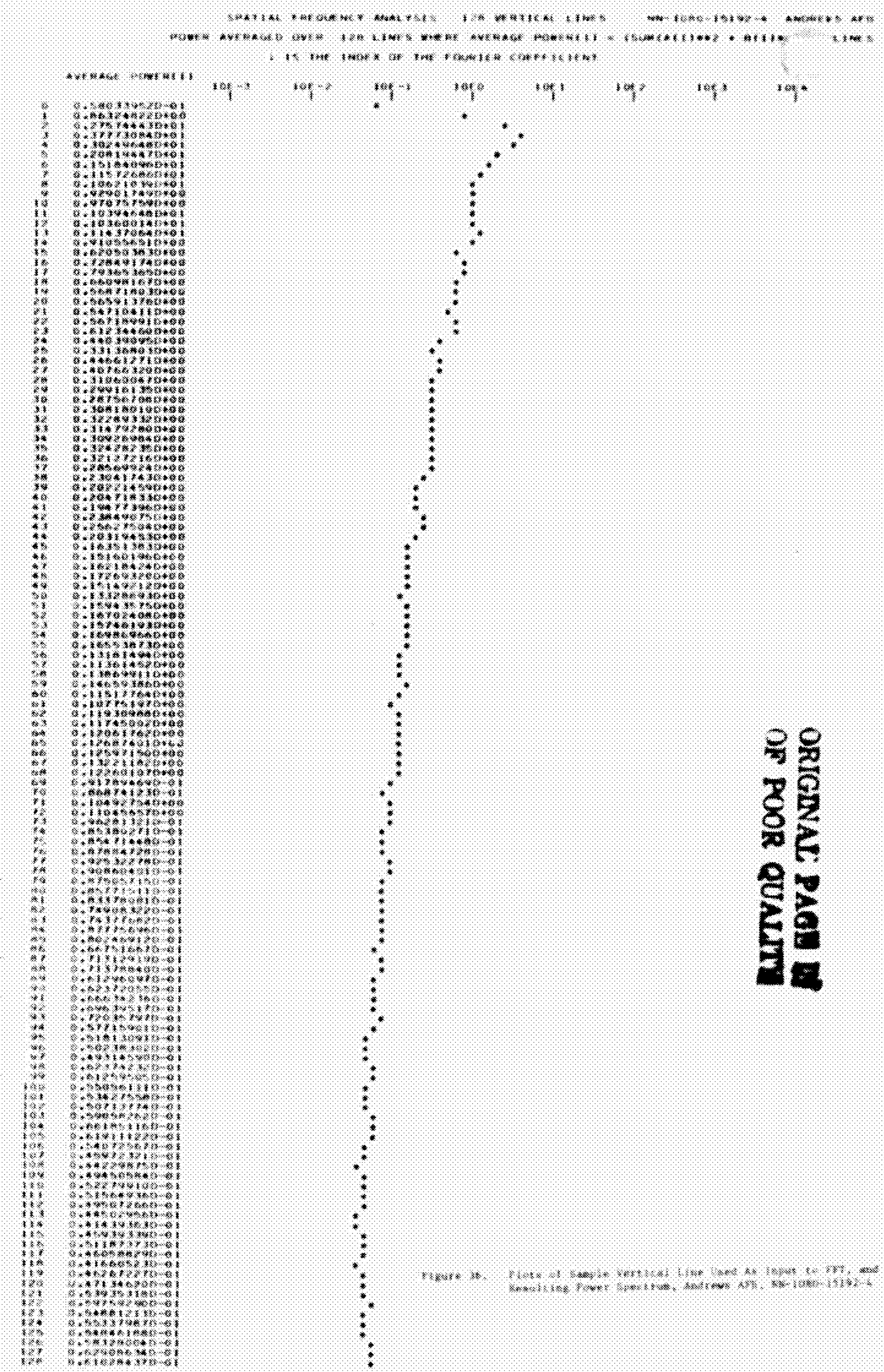


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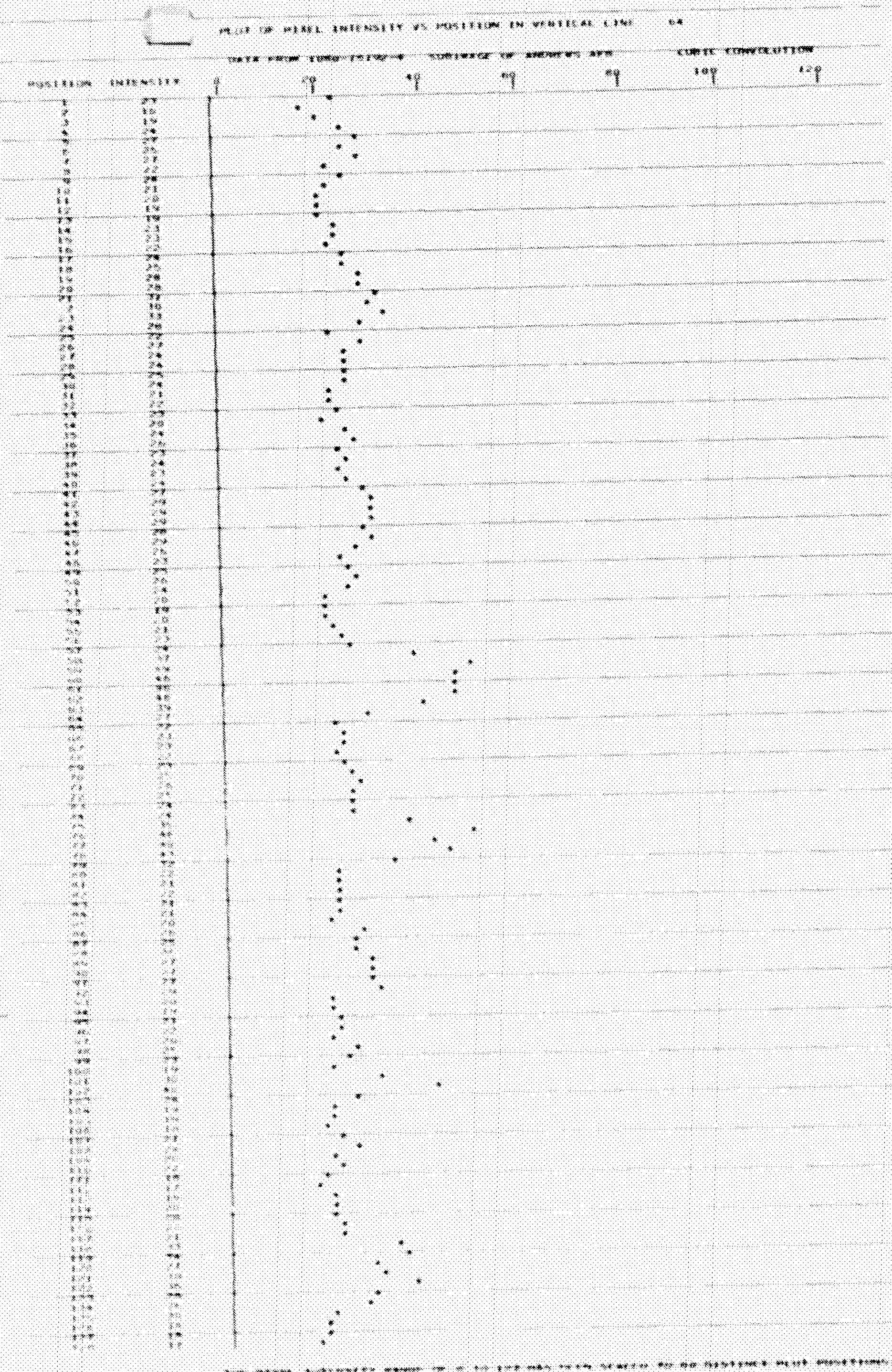
Figure 38. Plots of Sample Vertical Line Used As Input to FFT, and of Resulting Power Spectrum, Andrews AFB, NN-1080-15192-4



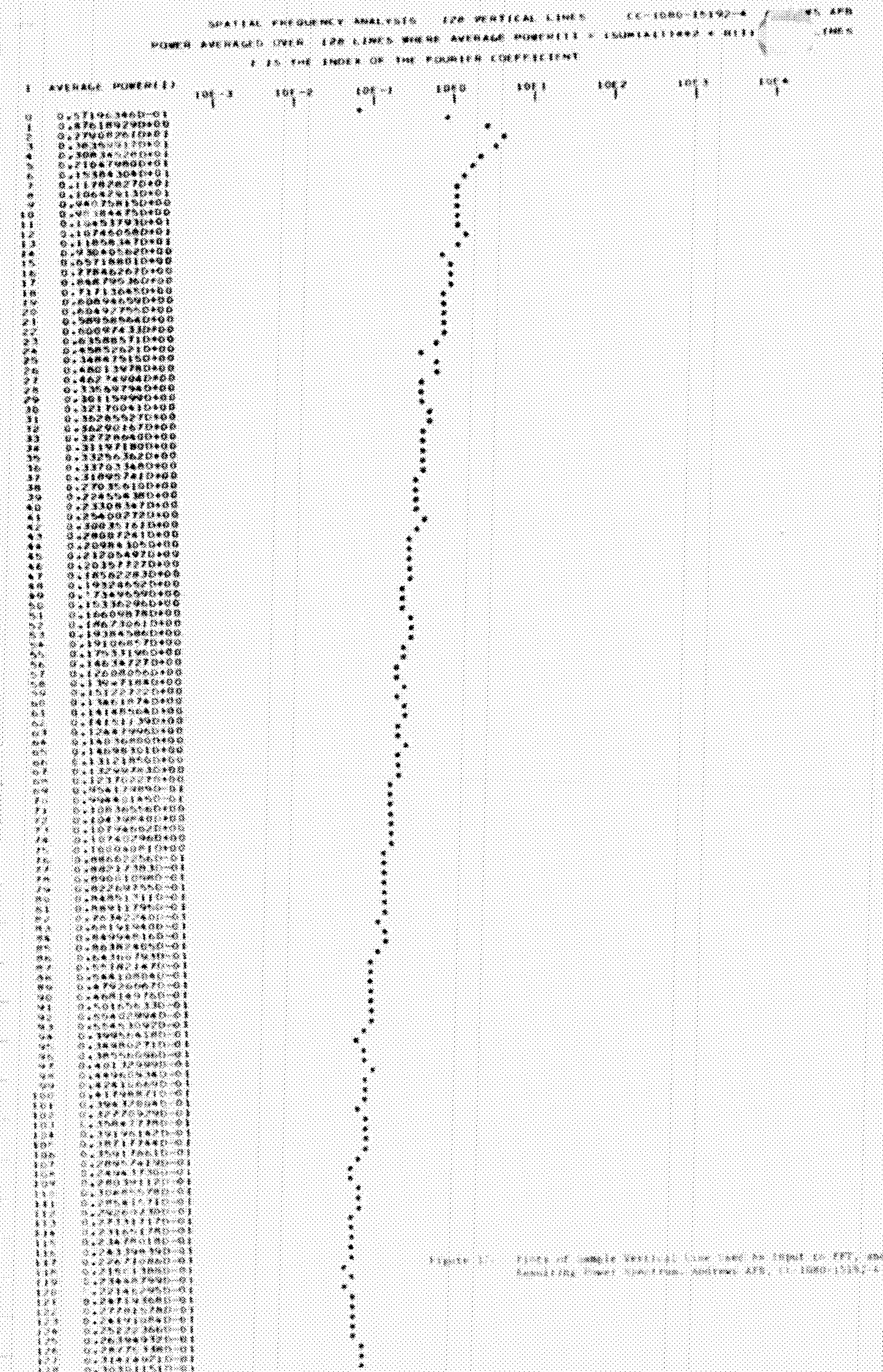


Figure 17. Plots of Sample Vertical Line Used As Input to FFT, and of Resulting Power Spectrum, Andrews AFB, CC-1080-15192-4

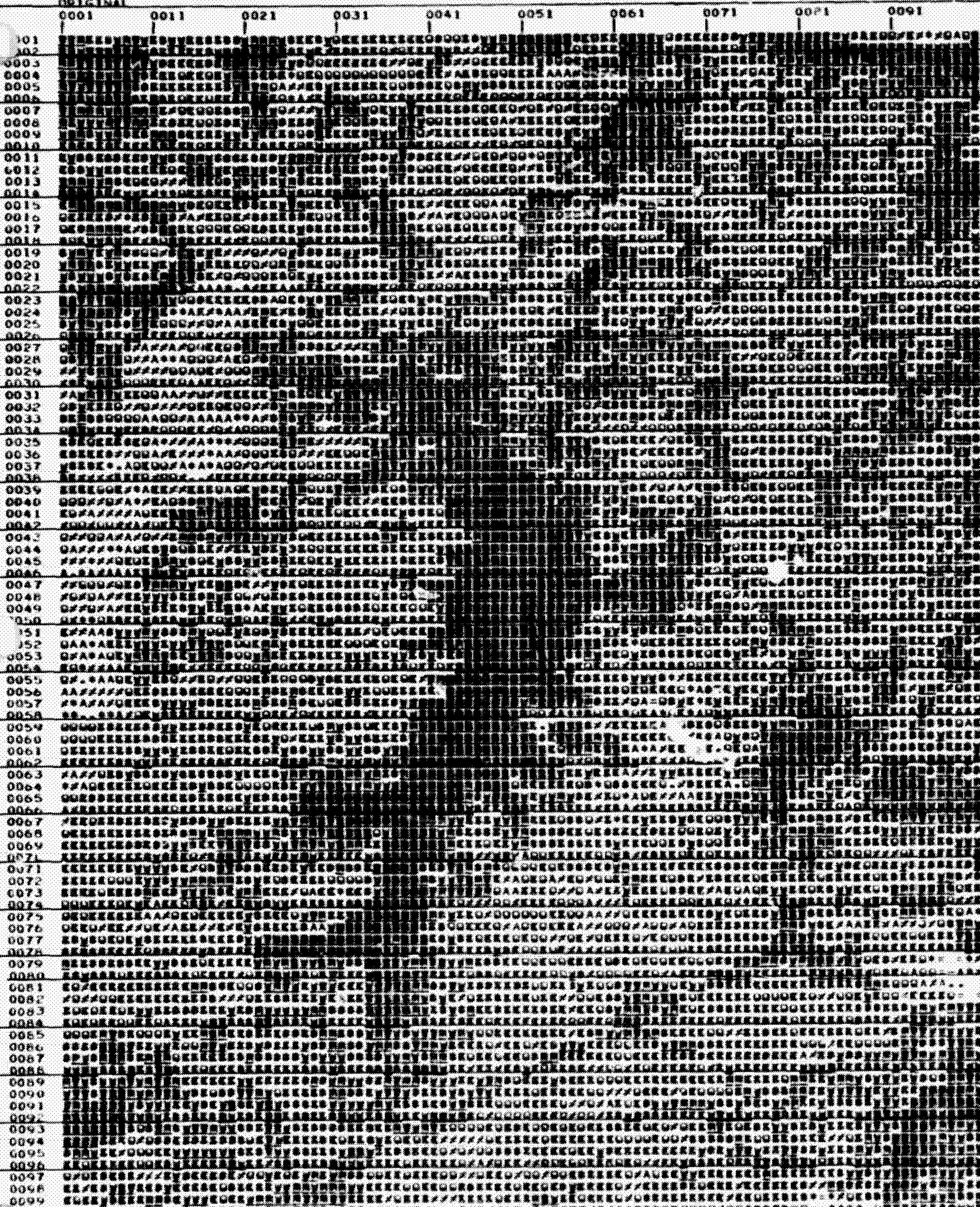


Figure 38. Shadeprint Of Lake Of The Woods, Va OR-1080-15192-7

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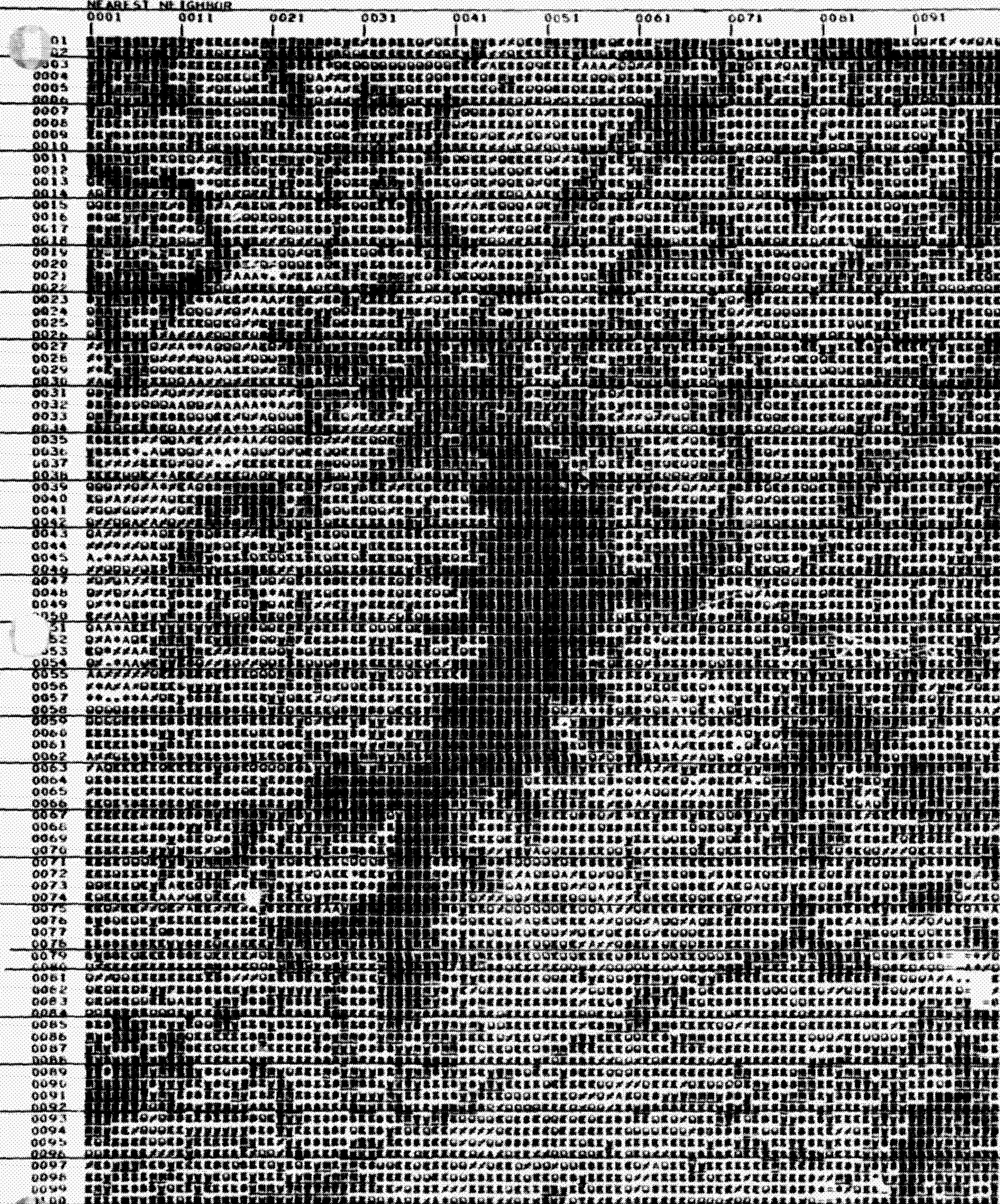

Figure 39. Shadeprint Of Lake Of The Woods, Va NN-1080-15193-7

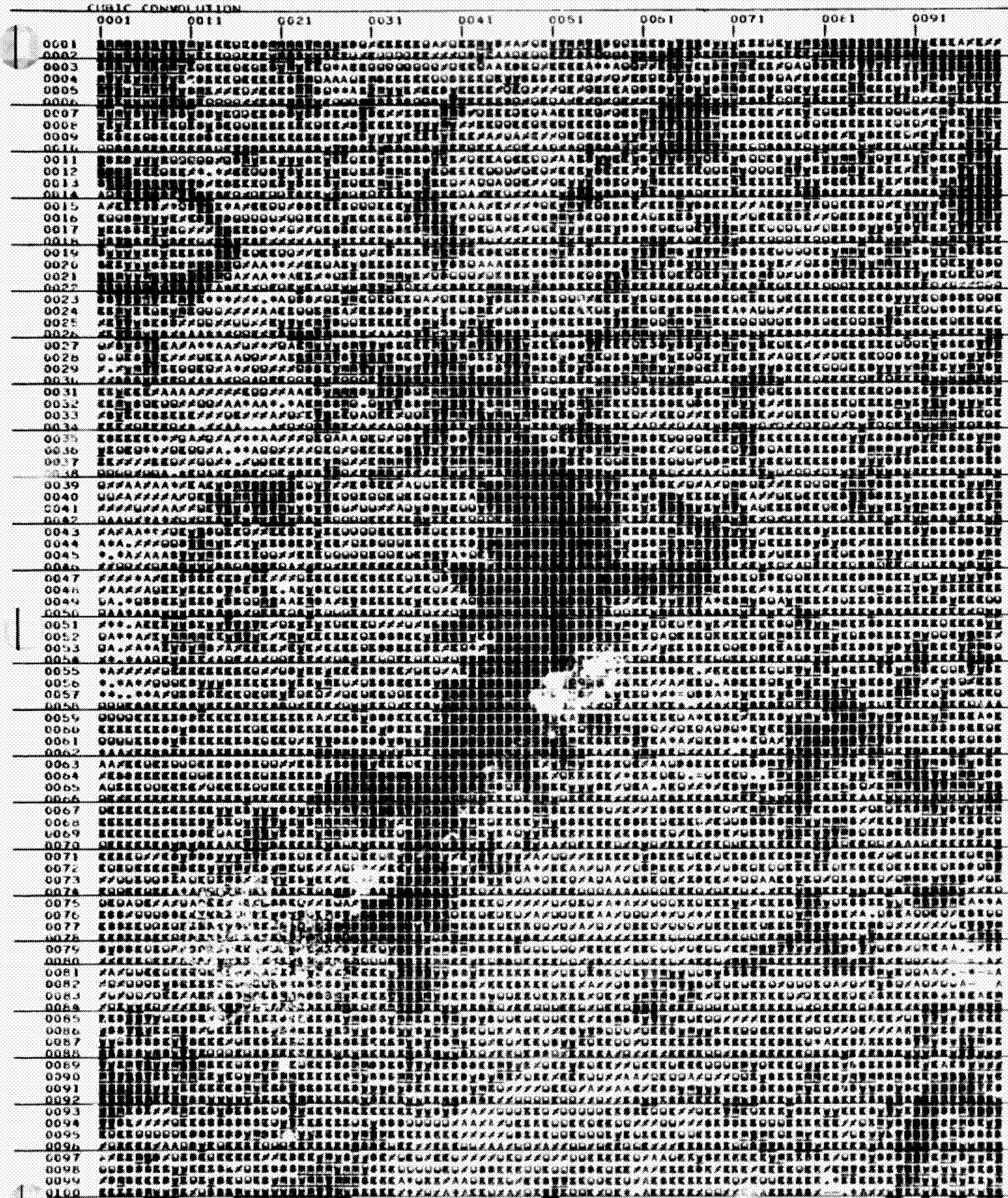

Figure 40. Shadeprint of Lake Of The Woods, Va CC-1080-15192-2

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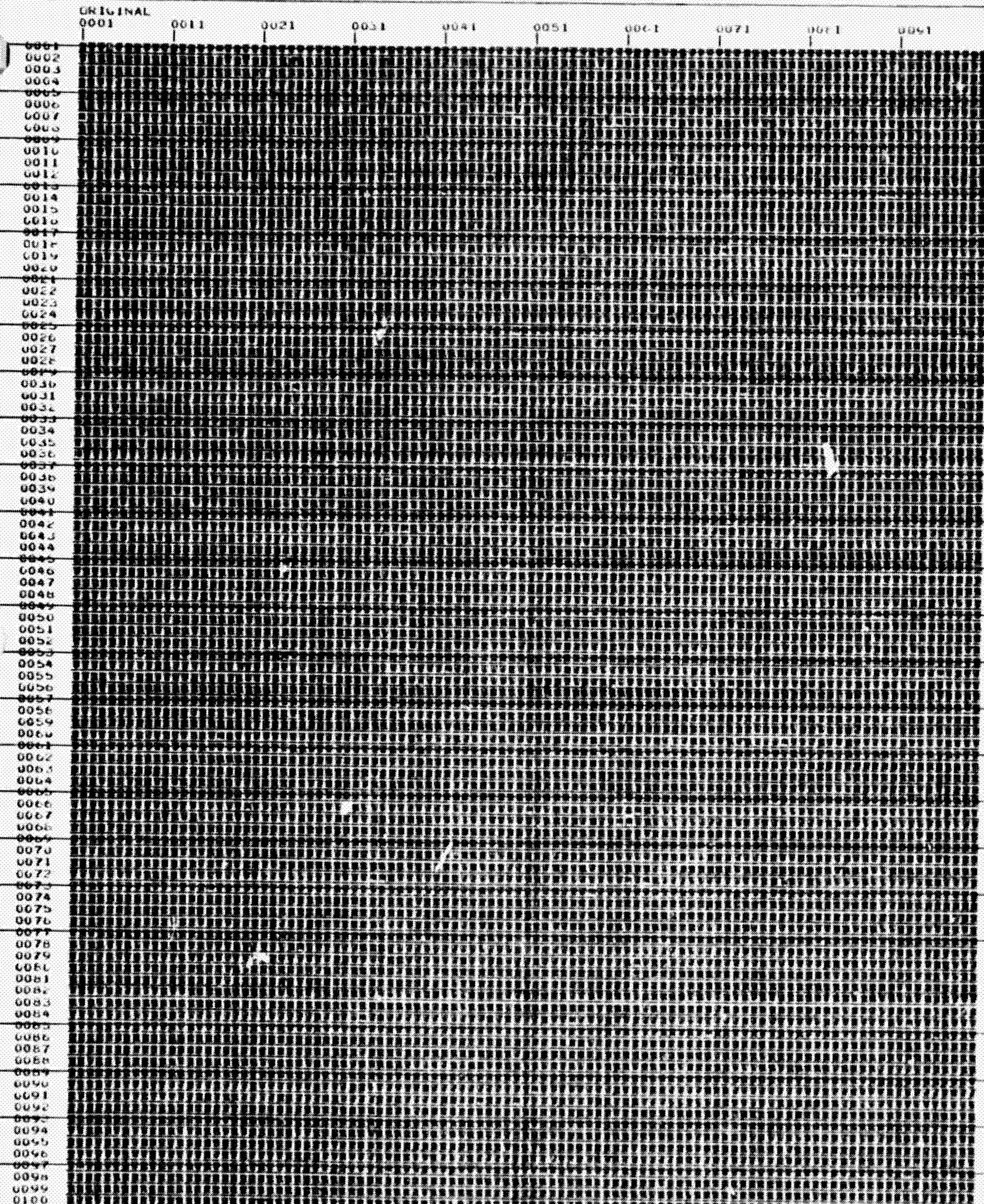

Figure 41. Shadeprint of Chesapeake Bay, Southeast Of Point Lookout, OR-1080-15192-7

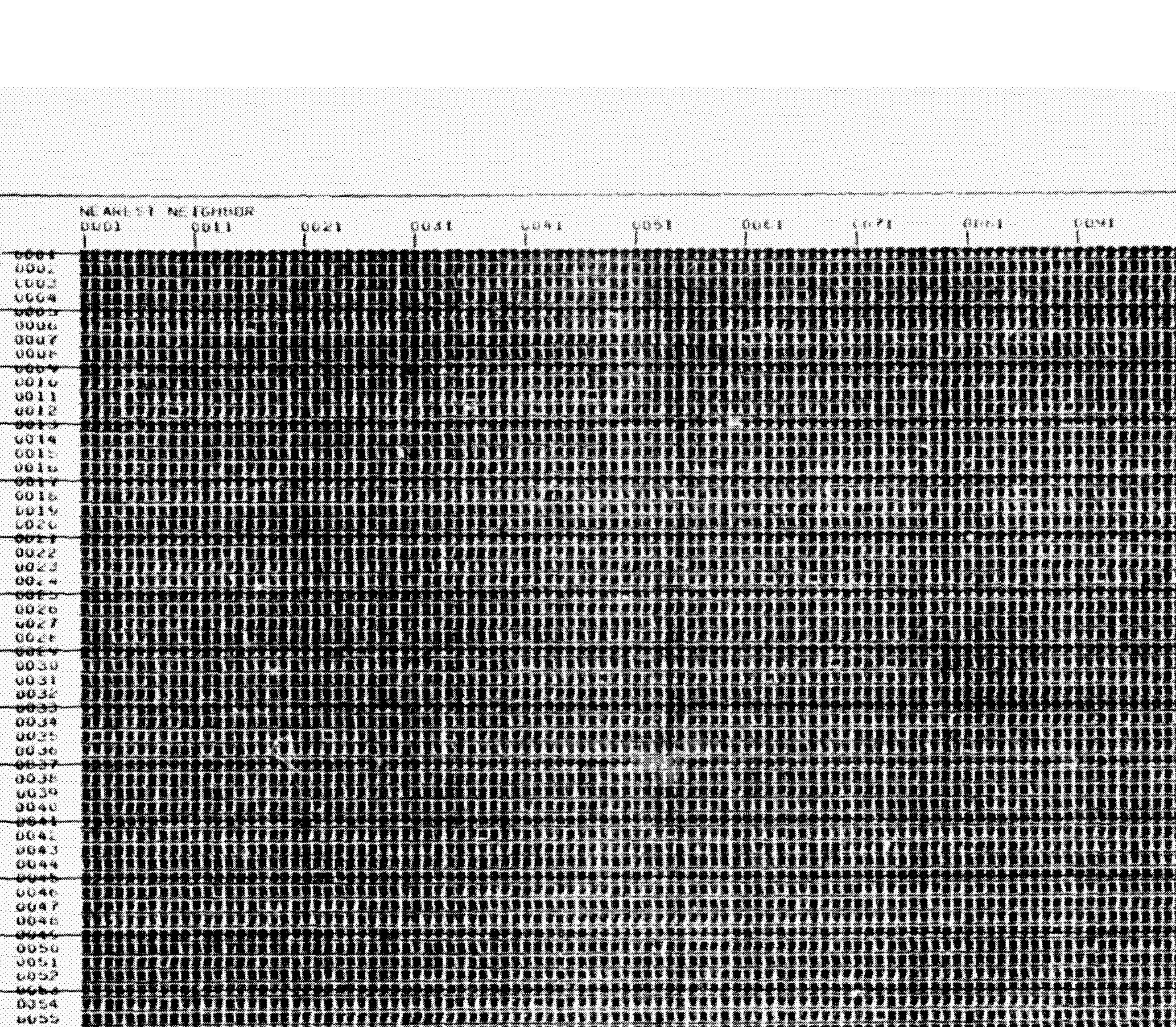

Figure 42. Shadeprint of Chesapeake Bay, Southeast Of Point Lookout, *NN-1080-15192-7*

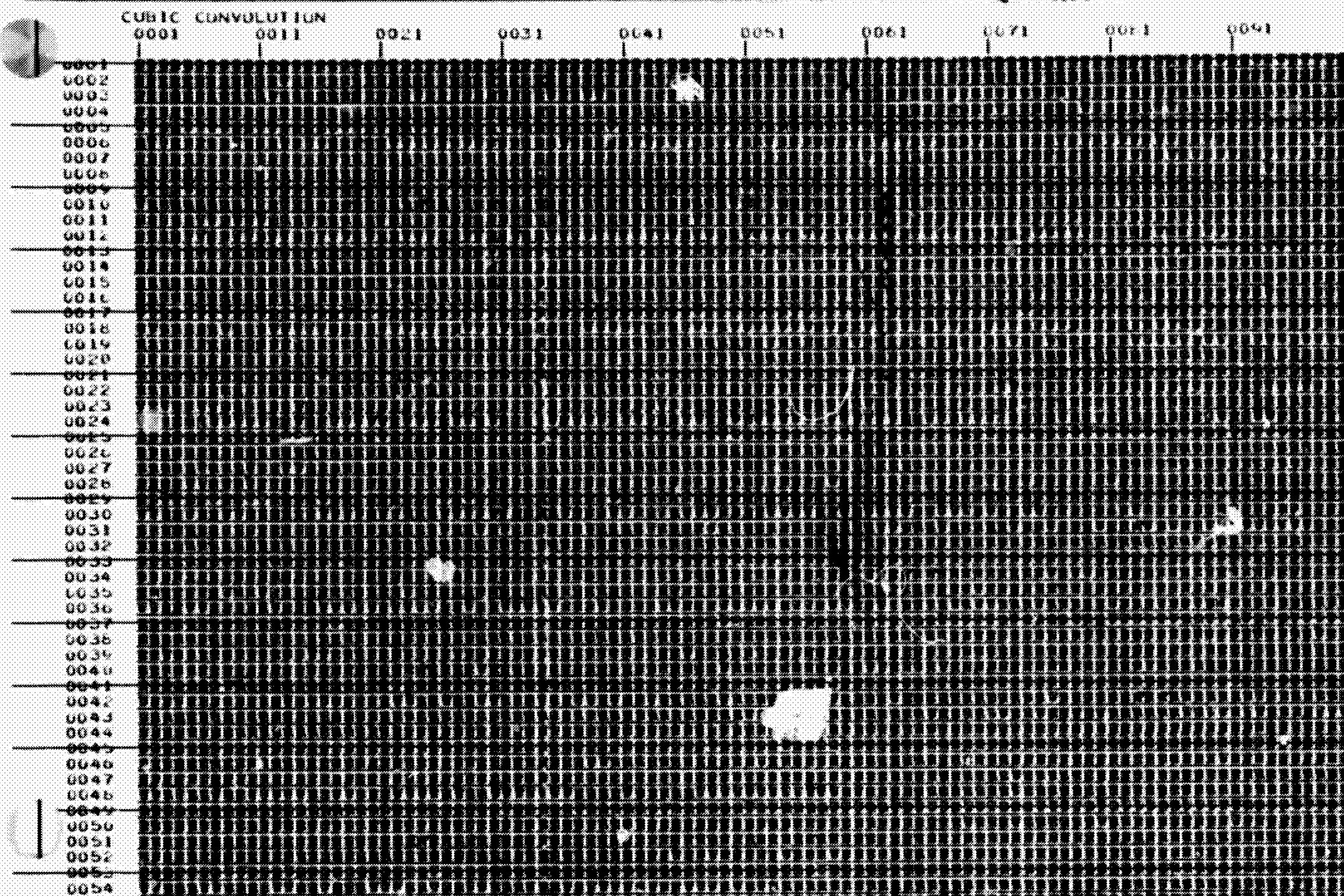

Figure 43. Shadeprint Of Chesapeake Bay, Southeast Of Point Lookout, CC-1080-15192-7

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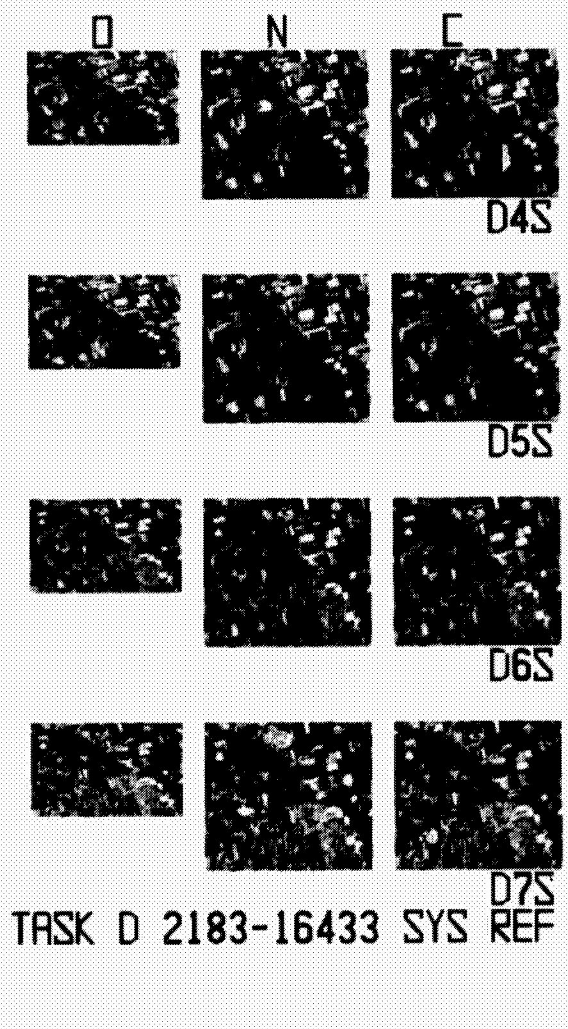

Figure 44. Contact print of LACIE intensive test site,
Hand County #2, South Dakota. Reference image
OR,NN,CC-2183-16433-4,5,6,7

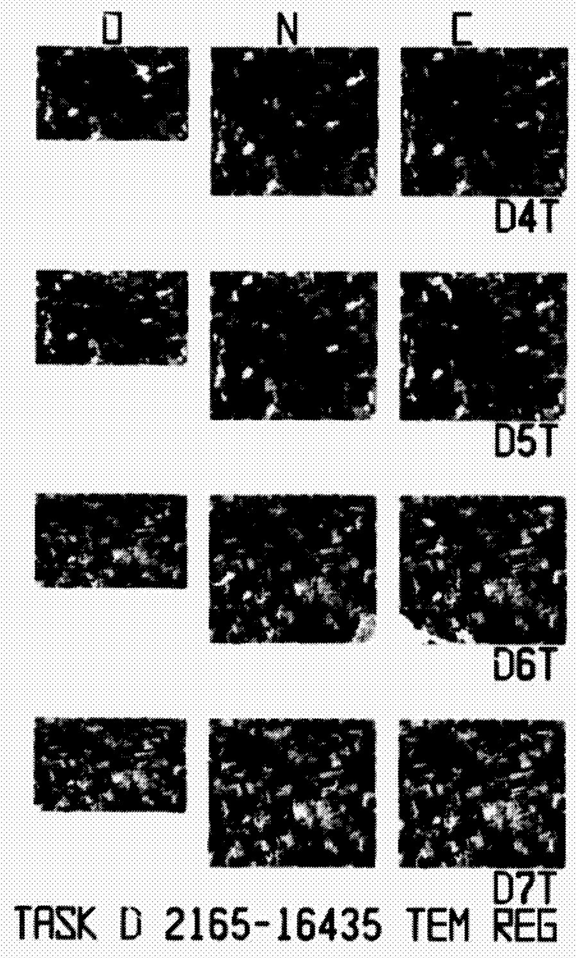

Figure 45. Contact print of LACIE intensive test site, Hand County #2, South Dakota. Register image OR,NN,CC-2165-16435-4,5,6,7

Figure 46. 10X Enlargement of LACIE Site, Reference Image OR-2183-16433-4

Figure 47. 10X Enlargement of LACIE Site, Reference Image OR-2183-16433-5

Figure 48. 10X Enlargement of LACIE Site, Reference Image OR-2183-16433-6

Figure 49. 10X Enlargement of LACIE Site, Reference Image OR-2183-16433-7

Figure 50. 10X Enlargement of LACIE Site, Reference Image NN-2183-16433-4

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Figure 51. 10X Enlargement of LACIE Site, Reference Image NN-2183-16433-5

Figure 52. 10X Enlargement of LACIE Site, Reference Image NN-2183-16433-6

Figure 53. 10X Enlargement of LACIE Site, Reference Image NN-2183-16433-7

Figure 54. 10X Enlargement of LACIE Site, Reference Image CC-2183-16433-4

Figure 55. 10X Enlargement of LACIE Site, Reference Image CC-2183-16433-5

Figure 56. 10X Enlargement o: LACIE Site, Reference Image CC-2183-16433-6

Figure 57. 10X Enlargement of LACIE Site, Reference Image CC-2183-16433-7

Figur 58. 10X Enlargement of LACIE Site, Register Image OR-2165-16435-4

Figure 59. 10X Enlar_ ment of LACIE Site, Register Image OR-2165-16435-5

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Figure 60. 10X Enlargement of LACIE Site, Register Image OR-2165-16435-6

Figure 61. 10X Enlargement of LACIE Site, Register Image OR-2165-16435-7

Figure 62. 10X Enlargement of LACIE Site, Register Image NN-2165-16435-4

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Figure 63. 10X Enlargement of LACIE Site, Register Image NN-2165-16435-5

Figure 64. 10X Enlargement of LACIE Site, Register Image NN-2165-16435-6

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Figure 65. 10X Enlargement of LACIE Site, Register Image NN-2165-16435-7

6f ... nlargement of LACIE Site, Register Image CC-2165-16435-4

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Figure 67. 10X Enlargement of LACIE Site, Register Image CC-2165-16435-5

Figure 58. 10X Enlargement of LACIE Site, Register Image CC-2165-16435-6

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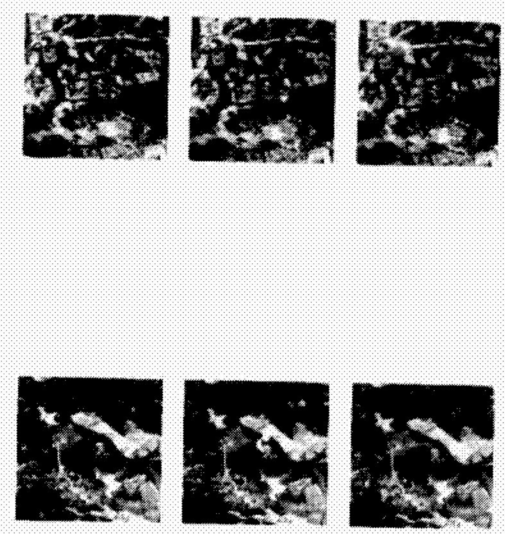
Figure 69. 10X Enlargement of LACIE Site, Register Image CC-2165-16435-7

Image	Areal Proportion Estimates %			
	Corn	Oats	Pasture/grasses	Spring Wheat
Ground Truth Map	8.06	6.47	81.23	4.24
NN-2165-16435	12.62	10.76	64.12	12.50
CC-2165-16435	12.25	11.14	63.47	13.15
NN-2183-16433	7.47	5.62	76.08	10.83
CC-2183-16433	6.44	5.55	79.42	8.58

Figure 70. Results of the Multispectral Classification Experiment

Figure Numbers 71-79 are not used in this report

OR NN CC



Area 1

Area 2

Figure 80. Contact print of Area 1 and Area 2, Monterey vicinity, Reference image OR,NN,CC-1921-18022-5

OR NN CC

Area 1

Area 2

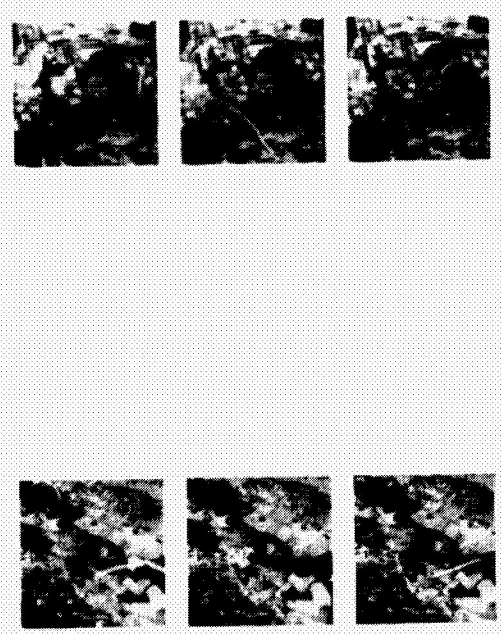


Figure 81. Contact print of Area 1 and Area 2, Monterey vicinity, Register image OR,NN,CC-1813-18063-5

Figure 82. 10X Enlargement of Area 1, Reference Image OR-1921-18022-5

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Figure 83. 10X Enlargement of Area 1, Reference Image NN-1921-18022-5

Figure 84. 10X Enlargement of Area 1, Reference Image CC-1921-18022-5

Figure 85. 10X Enlargement of Area 2, Reference Image OR-1921-18022-5

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Figure 86. 10X Enlargement of Area 2, Reference Image NN-1921-18022-5

Figure 87. 10X Enlargement of Area 2, Reference Image CC-1921-18022-5

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Figure 88. 10X Enlargement of Area 1, Register Image OR-1813-18063-5

Figure 89. 10X Enlargement of Area 1, Register Image NN-1813-18063-5

Figure 90. 10X Enlargement of Area 1, Register Image CC-1813-18063-5

Figure 91. 10X Enlargement of Area 2, Register Image OR-1813-18063-5

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Figure 92. 10X Enlargement of Area 2, Register Image NN-1813-18063-5

Figure 93. 10X Enlargement of Area 2, Register Image CC-1813-18063-5

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FOLDOUT FRAME 1

FOLDOUT FRAME 2

ORIGINAL PAGE IS
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Figure 9b. Shadeprint of Area 1, Reference Image, 08-1921-18022-5

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FOLDOUT FRAME 2

ORIGINAL PAGE IS
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FOLDOUT FRAME 1

FOLDOUT FRAME 2

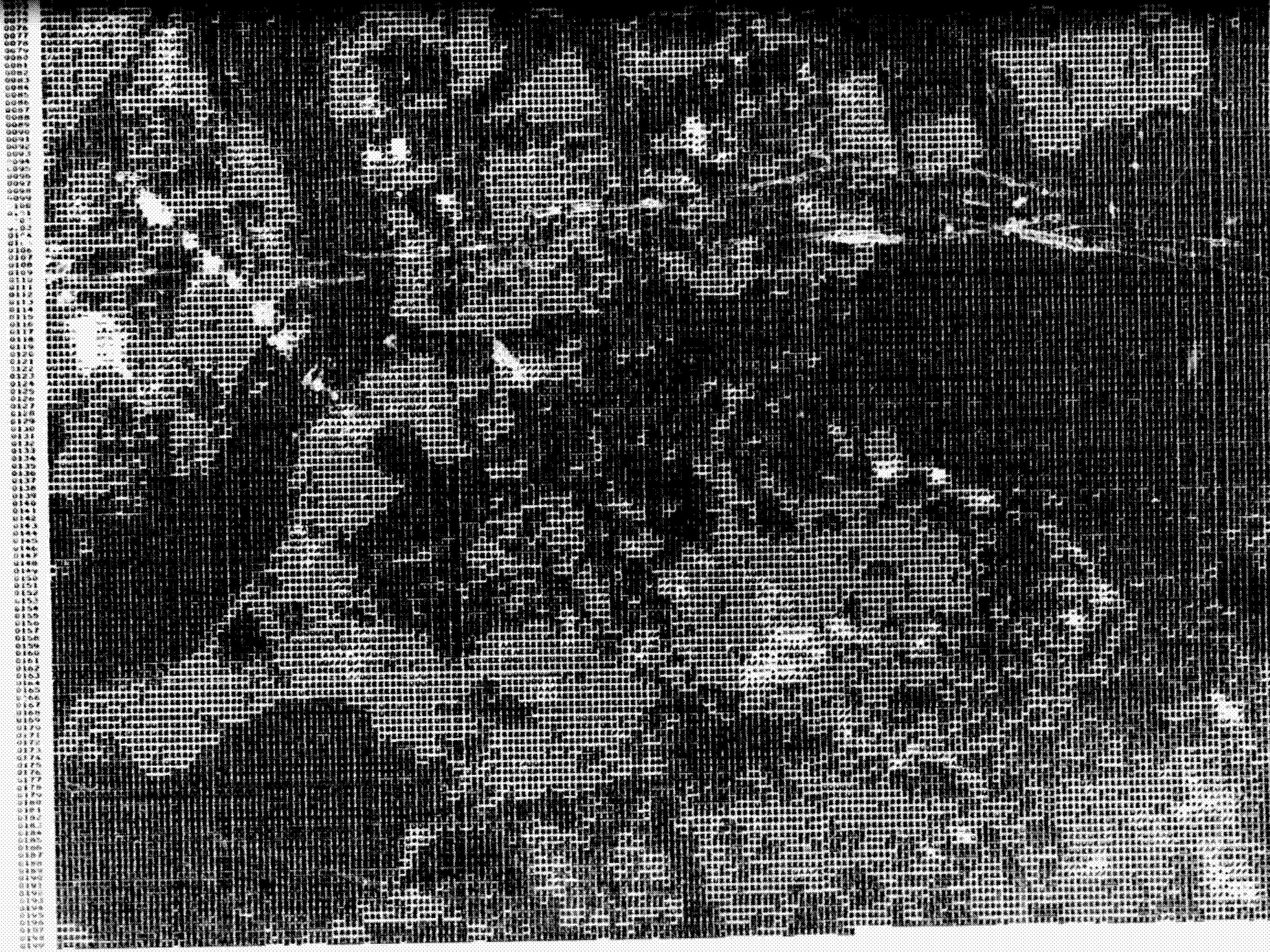

Figure 46. Shadeprint of Area 1, Reference Image, CC-1921-18022-5

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Figure 17. Shadeprint of Area 2, Reference Image, 08-1921-18022-5

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FOLDOUT FRAME 2

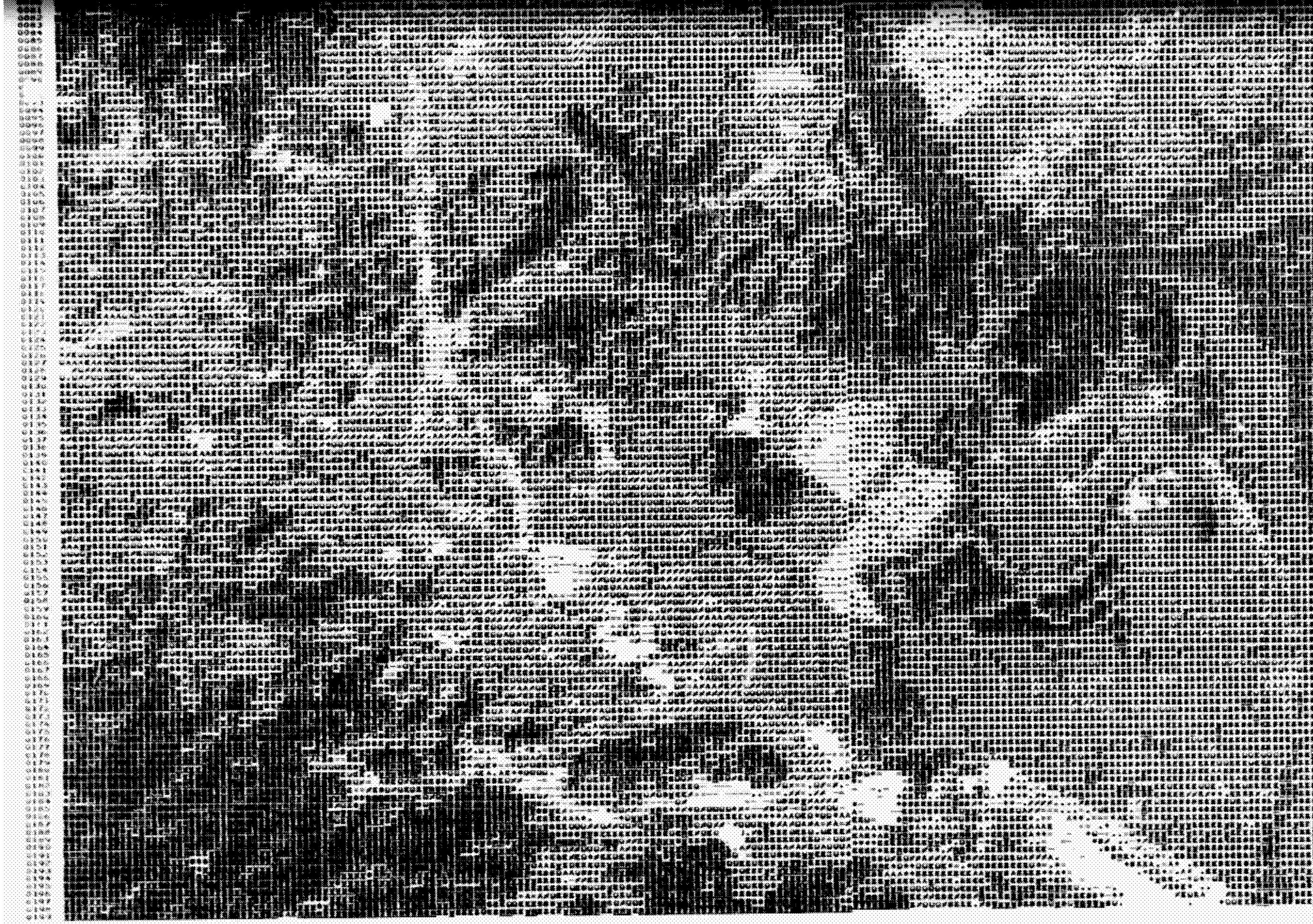

Figure 98. Shadeprint of Area 2, Reference Image, NN-1921-18022-5

FOLDOUT FRAME 1

FOLDOUT FRAME 2

Figure 99. Shadeprint of Area 2, Reference Image, [illegible]

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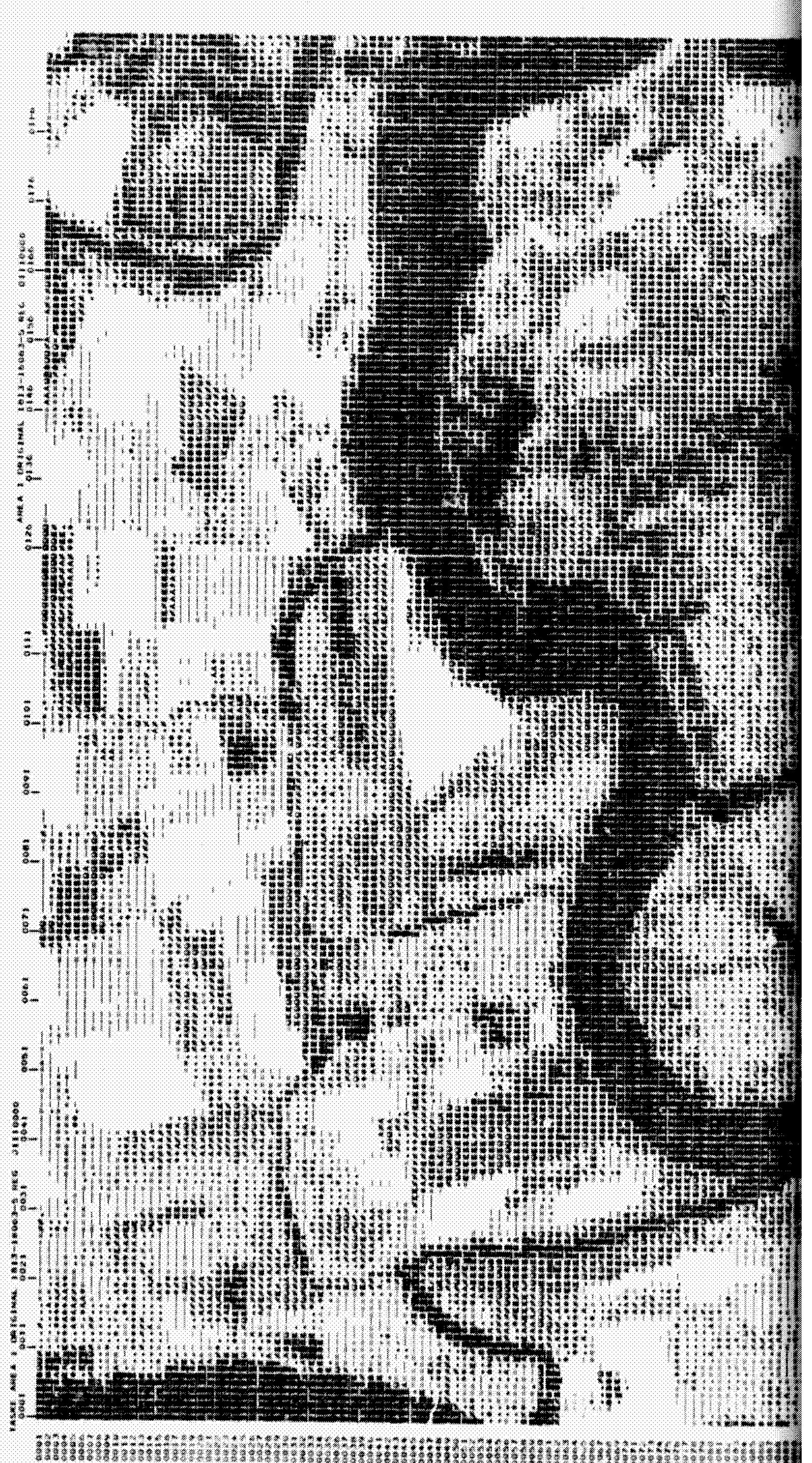

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Figure 100. Shadeprint of Area 1, Register Image, CR-1813-18063-5

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Figure 103. Shadeprint of Area 1, Registered Image, [illegible]

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FOLDOUT FRAME 2

Figure 102. Shadeprint of Area 1, Register Image. CC-1013-18061-5

FOLDOUT FRAME 1

FOLDOUT FRAME 2

Figure 103. Shadeprint of Area 2, Register Image, ER-1813-18063-5

FOLDOUT FRAME 1

FOLDOUT FRAME 2

Figure 10a. Shadeprint of Area 2, Registered Image, SR-1813-28063-3

FOLDOUT FRAME 1

FOLDOUT FRAME 2

Figure 105. Shadeprint of Area 2, Register Image, CC-1817 (8063-5

Appendix A

Ground Truth Information

for

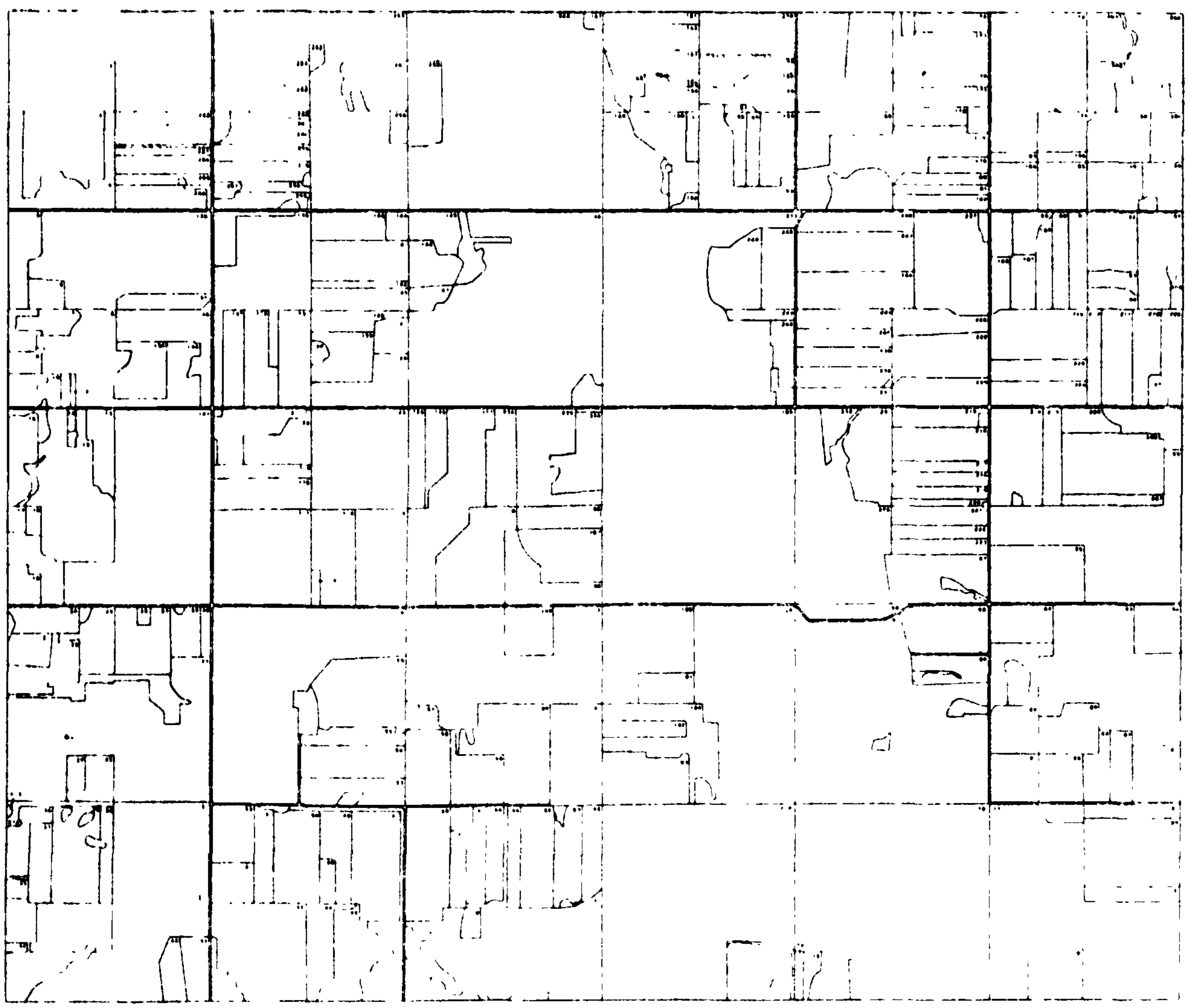
Hand County, South Dakota

Site 2

HAND COUNTY, SOUTH DAKOTA SITE 2

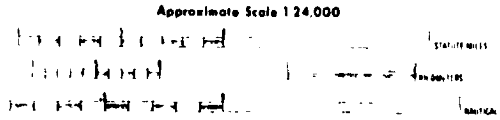
LACIE INTENSIVE STUDY SITE

TEST SITE No. [illegible] (LACIE [illegible])



Photography Acquired June 1975

Approximate Scale 1:24,000



Land Use Data Collected by The ASCS June 1975

Prepared by
FSO Cartographic Laboratory
Earth Observations Division
S & AD JSC/NASA
Houston Texas January 1976

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TEST SITE ~~# 35 (HA?L(2), S.D.)~~ INVENTORY OBSERVATION

GROUND TRUTH INVENTORY FORM

DATA RECORDED BETWEEN - 6/26/75 AND - 6/26/75

LAND USE CROP CODES

100 SPRING WHEAT (GEN) CODE LIST ATTACHED
200 BARLEY (GEN)
201 [illegible]
202 [illegible]
203 [illegible]
204 [illegible]
205 [illegible]
206 [illegible]
207 [illegible]
208 [illegible]
209 [illegible]
210 [illegible]
211 PARAGON
212 [illegible]
213 CONQUEST
214 WISCONSIN
215 [illegible]
216 [illegible]
217 [illegible]
300 OATS (GEN)
301 RUSSELL
302 [illegible]
303 [illegible]
304 [illegible]
305 [illegible]
306 KINSEY
307 HARMON
308 MISSION
400 WINTER WHEAT (GEN)
401 DARK HARD NORTHERN
402 SCOUT
403 [illegible]
404 EAGLE
405 APACHE
406 TRIUMPH
407 SATANTA
408 CENTURK
409 BISON
410 [illegible]
411 MCCALL
412 [illegible]
413 [illegible]
414 [illegible]
415 [illegible]
416 [illegible]
417 BURT
418 [illegible]
419 ARTHUR
420 TASCOSA
421 STURDY
422 [illegible]
423 CAPRICK
424 EAGLE SCOUT
425 [illegible]
426 CHEYENNE
427 [illegible]
428 [illegible]
500 GRASSES/PASTURE ETC.
600 OTHER CROPS (GEN)
601 RAPESEED
602 RYE
603 MUSTARD
604 FLAX (GEN)
605 [illegible] FLAX
606 REDWOOD FLAX
607 CORN
610 BUCKWHEAT
611 SUNFLOWERS
612 DRY BEANS
613 LENTILS
614 DRY PEAS
615 SUGAR BEETS
616 GRAIN SORGHUM
617 SOYBEANS
619 COTTON
700 SUMMER FALLOW
800 NON-AGRICULTURE
900 UNKNOWN CROPS

MAP REFERENCE # OF FIELD	ACREAGE	LAND USE CROP CODE	IRRIGATED	FERTILIZED	PLANTING DATE MONTH DAY YEAR	COMMENTS
1	256.3	501	Y N	Y N	-- / -- / --	
2	70.4	502	Y N	Y N	Before -- / 70	10# 0-20-0
3	91.9	504	Y N	Y N	-- / -- / --	
4	69.9	1[illegible]2	Y N	Y N	5 / [illegible] / 75	[illegible], N-S, 7"
5	.71	202	Y N	Y N	5 / 12 / 75	[illegible], N-S, 7"
6	17.7	505	Y N	Y N	Before -- / 70	
7	16.3	505	Y N	Y N	Before -- / 70	
8	116.7	501	Y N	Y N	-- / -- / --	
9	8.8	500	Y N	Y N	5 / 25 / 75	Sudan - E-W, 42"
10	24.5	505	Y N	Y N	5 / -- / 71	
11	4.9	500	Y N	Y N	6 / 1 / 75	Sudan, N-S, 42"
12	2.7	504	Y N	Y N	Before -- / 70	
13	31.1	607	Y N	Y N	5 / 23 / 75	N-S, 40"
14	3.2	607	Y N	Y N	5 / 23 / 75	N-S, 42"
15	145.2	505	Y N	Y N	5 / -- / 71	[illegible]
16	37.1	300	Y N	Y N	5 / 10 / 75	N-S 7", ~~[illegible]~~, Unknown
17	3.71	501	Y N	Y N	-- / -- / --	
18	6.9	502	Y N	Y N	Before -- / 70	
19	18.2	503	Y N	Y N	Before -- / 70	
20	27.5	503	Y N	Y N	Before -- / 70	
21	23.4	505	Y N	Y N	Before -- / 70	
22	43.4	504	Y N	Y N	-- / -- / --	
23	352.4	501	Y N	Y N	-- / -- / --	
24	12.0	504	Y N	Y N	-- / -- / --	
25	26.2	505	Y N	Y N	Before -- / 70	
26	40.1	502	Y N	Y N	Before -- / 70	
27	42.5	607	Y N	Y N	5 / 26 / 70	N-S 42"
28	5.2	504	Y N	Y N	-- / -- / --	

100: 745.8
300: 1235.3
500: 14249.1
600: 1482.8

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TEST SITE # 35 (HAND(2), S.D.)
INVENTORY OBSERVATION

GROUND TRUTH INVENTORY FORM

DATA RECORDED BETWEEN 6/24/75 AND 6/26/75

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of 11

LAND USE CROP CODES

100 SPRING WHEAT (GEN) CV'S LIST ATTACHED	211 PARAGON	306 KINSEY	410 WANSER	423 CAPROCK	606 REDWOOD FLAX
200 BARLEY (GEN)	212 HERTA	307 HANSON	411 MCCALL	424 EAGLE SCOUT	607 CORN
201 LARKER	213 CONQUEST	308 MISSION	412 [illegible]	425 TRAPPER	610 BUCKWHEAT
202 [illegible]	214 WISCONSIN	400 WINTER WHEAT (GEN)	413 GAINES	426 [illegible]	611 SUNFLOWERS
203 [illegible]	215 [illegible]	401 DARK HARD NORTHERN	414 NUGAINES	427 [illegible]	612 DRY BEANS
204 DICKSON	216 [illegible]	402 SCOUT	415 [illegible]	428 [illegible]	613 LENTILS
205 [illegible]	217 MOREVIAN	403 PARKER	416 [illegible]	500 GRASSES/PASTURE ETC.	614 DRY PEAS
206 [illegible]	300 OATS (GEN)	404 EAGLE	417 [illegible]	600 OTHER CROPS (GEN)	615 SUGAR BEETS
207 [illegible]	301 RUSSELL	405 APACHE	418 [illegible]	601 RAPESEED	616 GRAIN SORGHUM
208 [illegible]	302 [illegible]	406 TRIUMPH	419 [illegible]	602 RYE	617 SOYBEANS
209 [illegible]	303 [illegible]	407 SATANTA	420 TASCOSA	603 MUSTARD	618 COTTON
210 [illegible]	304 [illegible]	408 CENTURK	421 STURDY	604 FLAX (GEN)	700 SUMMER FALLOW
213 [illegible]	305 LODI	409 BISON	422 CONCHO	605 [illegible] FLAX	800 NON-AGRICULTURE
					900 UNKNOWN CROPS

MAP REFERENCE # OF FIELD	ACREAGE	LAND USE CROP CODE	IRRIGATED	FERTILIZED	PLANTING DATE MONTH DAY YEAR	COMMENTS
29	28.1	6 0 7	Y N	Y N	5/21/75	N.S. 42"
30	8.5	5 0 4	Y N	Y N	—/—/—	
31	238.8	5 0 1	Y N	Y N	—/—/—	
32	25.9	5 0 8	Y N	Y N	Before /70	
33	21.7	3 0 0	Y N	Y N	5/14/75	N.S. 7" [illegible] seeded, Burnett
34	3.5	8 0 0	Y N	Y N	/ /	[illegible]
35	5.6	5 0 0	Y N	Y N	6/ /75	E.W. 42", [illegible]
36	28.1	3 0 0	Y N	Y N	4/30/75	N.S. 7" [illegible] alfalfa seeded
37	27.5	5 0 5	Y N	Y N	5/ /72	
38	74.8	3 0 0	Y N	Y N	4/29/75	N.S. 7", Noodoway 70
39	19.2	5 0 4	Y N	Y N	5/ /70	
40	52.2	6 0 7	Y N	Y N	5/22/75	E.W. 42"
41	26.0	6 0 7	Y N	Y N	5/17/75	N.S. 36"
42	122.1	5 0 2	Y N	Y N	before /70	
43	24.8	5 0 1	Y N	Y N	—/—/—	
44	50.3	5 0 2	Y N	Y N	before /70	[illegible] 45
45	53.5	5 0 1	Y N	Y N	—/—/—	[illegible] 44
46	10.0	8 0 0	Y N	Y N	7/5/75	[illegible] Planted to No. 275
47	84.8	5 0 5	Y N	Y N	5/ /72	
48	11.3	5 0 5	Y N	Y N	5/ /72	
49	37.9	4 0 4	Y N	Y N	4/24/75	Broadcast,
50	71.1	3 0 8	Y N	Y N	4/28/75	Broadcast, [illegible] Barley, grass 2 [illegible]
51	32.1	5 0 5	Y N	Y N	5/ /70	
52	39.4	5 0 1	Y N	Y N	—/—/—	
53	45.8	5 0 8	Y N	Y N	5/ /74	
54	53.1	6 0 7	Y N	Y N	5/19/75	E.W. 42"
55	25.9	5 0 0	Y N	Y N	6/15/75	[illegible], E.W. 42"
56	99.8	5 0 5	Y N	Y N	5/ /72	9 [illegible]

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TEST SITE # 35 (HAND(?), S.D.)
INVENTORY OBSERVATION

GROUND TRUTH INVENTORY FORM

DATA RECORDED BETWEEN 8/24/75 AND 8/26/75

LAND USE CROP CODES

100 SPRING WHEAT (GEN) (TYPE LIST ATTACHED)
200 BARLEY (GEN)
211 PARAGON
212 HERTA
213 CONQUEST
214 WISCONSIN
215 [illegible]
217 [illegible]
300 OATS (GEN)
301 RUSSELL
302 [illegible]
303 KELSEY
304 [illegible]
305 [illegible]
301 KINSEY
303 MISSION
400 WINTER WHEAT (GEN)
401 DARK HARD NORTHERN
402 SCOUT
404 [illegible]
405 APACHE
406 TRIUMPH
407 SATANTA
408 CENTURK
409 BISON
410 KANSER
411 MCCALL
412 WREVUR
413 [illegible]
414 [illegible]
415 [illegible]
416 [illegible]
417 [illegible]
418 BRIDGER
419 ANTHUR
420 TASCOSA
421 STURDY
422 CONCHO
423 [illegible]
424 EAGLE SCOUT
425 [illegible]
426 CHEYENNE
427 [illegible]
428 [illegible]
500 GRASSES/PASTURE ETC.
600 OTHER CROPS (GEN)
601 RAPESEED
602 RYE
603 MUSTARD
604 FLAX (GEN)
605 [illegible] FLAX
606 REDWOOD FLAX
607 CORN
610 BUCKWHEAT
611 SUNFLOWERS
612 DRY BEANS
613 LENTILS
614 DRY PEAS
615 SUGAR BEETS
616 GRAIN SORGHUM
617 SOYBEANS
618 COTTON
700 SUMMER FALLOW
800 NON-AGRICULTURE
900 UNKNOWN CROPS

MAP REFERENCE # OF FIELD	ACREAGE	LAND USE CROP CODE	IRRIGATED	FERTILIZED	PLANTING DATE MONTH DAY YEAR	COMMENTS
57	9.1	2 0 0	Y (N)	Y (N)	5 / 1 / 75	Broadcast, Unknown variety
58	53.0	6 0 7	Y (N)	Y (N)	6 / 20 / 75	E-W, 24"
59	43.7	– – –	Y (N)	Y (N)	5 / 10 / 75	[illegible] Alfalfa Broadcast, [illegible]
60	106.5	2 0 0	Y (N)	Y (N)	5 / 10 / 75	N-S, 7", Unknown but old variety
61	82.2	5 0 0	Y (N)	Y (N)	– / – / –	
62	22.4	5 0 0	Y (N)	Y (N)	– / – / –	
63	38.3	6 0 7	Y (N)	Y (N)	5 / 26 / 75	N-S, 40"
64	57.9	3 0 0	Y (N)	Y (N)	5 / 16 / 75	N-S 6" [illegible]
65	33.2	2 0 0	Y (N)	Y (N)	5 / 10 / 75	N-S 6"
66	33.3	3 0 0	Y (N)	Y (N)	4 / 25 / 75	Broadcast, [illegible] Crop with Alfalfa & Grass
67	24.9	5 0 0	Y (N)	Y (N)	5 / – / 70	Planted with 68 & 69
68	23.7	5 0 0	Y (N)	Y (N)	– / – / –	Planted with 67 & 69
69	28.7	5 0 0	Y (N)	Y (N)	[illegible] / – / 70	Planted with 67 & 68
70	10.3	5 0 0	Y (N)	Y (N)	[illegible] / – / 70	
71	211.5	5 0 0	Y (N)	Y (N)	– / – / –	
72	26.9	5 0 0	Y (N)	Y (N)	– / – / –	
73	54.0	6 0 7	Y (N)	Y (N)	– / – / –	E-W 30"
74	6.7	5 0 5	Y (N)	(N)	5 / – / 70	
75	2.3	5 0 5	Y (N)	(N)	5 / – / 70	
76	64.2	5 0 0	Y (N)	Y (N)	– / – / –	
77	[illegible]	5 0 0	Y (N)	(N)	– / – / –	
78	41.6	3 0 0	Y (N)	Y (N)	4 / 25 / 75	[illegible], Broadcast
79	23.1	5 0 5	Y (N)	Y (N)	5 / – / 73	
80	84.7	6 0 7	Y (N)	Y (N)	5 / 20 / 75	E-W, 33"
81	37.9	5 0 0	Y (N)	Y (N)	5 / 29 / 75	E-W, 31" [illegible]
82	42.2	5 0 0	Y (N)	Y (N)	6 / 3 / 75	N-S, 3?" [illegible]
83	24.5	5 0 0	Y (N)	Y (N)	5 / 29 / 75	N-S, 38" [illegible]
84	25.3	6 0 7	Y (N)	Y (N)	5 / 27 / 75	N-S, 38"

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TEST SITE # 35 (HAND(?), S.D.)
INVENTORY OBSERVATION

GROUND TRUTH INVENTORY FORM

DATA RECORDED BETWEEN - 6/24/75
AND - 6/26/75

LAND USE CROP CODES

100 SPRING WHEAT (GEN)
C OF LIST ATTACHED
200 BARLEY (GEN)
201 LARKER
202 [illegible]
203 [illegible]
204 DICKSON
205 PRIMUS
206 [illegible]
207 PIROLINE
208 [illegible]
209 STEPTOE
210 FERGUS
211 PARAGON
212 [illegible]
213 CONQUEST
214 WISCONSIN
215 [illegible]
216 HYPANA
217 MORAVIAN
300 OATS (GEN)
301 RUSSELL
302 BASIN
303 KELSEY
304 [illegible]
305 LODI
306 KINSEY
307 HARMON
308 MISSION
400 WINTER WHEAT (GEN)
401 DARK HARD NORTHERN
402 SCOUT
403 PARKER
404 EAGLE
405 APACHE
406 TRIUMPH
407 SATANTA
408 CENTURK
409 BISON
410 WARNER
411 MCCALL
412 [illegible]
413 GAINES
414 NUGAINES
415 [illegible]
416 MORO
417 [illegible]
418 BRIDGER
419 ARTHUR
420 TASCOSA
421 STURDY
422 CONCHO
423 CAPROCK
424 EAGLE SCOUT
425 TRAPPER
426 CHEYENNE
427 [illegible]
428 [illegible]
500 GRASSES/PASTURE ETC.
600 OTHER CROPS (GEN)
601 RAPESEED
602 RYE
603 MUSTARD
604 FLAX (GEN)
605 N. DAKOTA FLAX
606 REDWOOD FLAX
607 CORN
610 BUCKWHEAT
611 SUNFLOWERS
612 DRY BEANS
613 LENTILS
614 DRY PEAS
615 SUGAR BEETS
616 GRAIN SORGHUM
617 SOYBEANS
618 COTTON
700 SUMMER FALLOW
800 NON-AGRICULTURE
900 UNKNOWN CROPS

MAP REFERENCE # OF FIELD	ACREAGE	LAND USE CROP CODE	IRRIGATED	FERTILIZED	PLANTING DATE MONTH DAY YEAR	COMMENTS
35	44.8	6 0 7	Y N	Y N	5/19/75	E.W. 21", 150# N 34, P 46, K 0 [illegible]
86	37.0	3 0 0	Y N	Y N	4/23/75	[illegible] broadcast, 100# N 34, P 44, K 0
87	38.6	5 0 1	Y N	Y N	–/–/–	
88	36.9	3 0 0	Y N	Y N	4/23/75	[illegible] broadcast, 80# N 34, P 44, K 0
89	35.2	3 2 0	Y N	Y N	4/22/75	[illegible] broadcast
90	64.0	6 0 4	Y N	Y N	5/24/75	E.W. 7" [illegible]
91	481.1	5 0 1	Y N	Y N	–/–/–	
92	36.1	5 0 0	Y N	Y N	6/24/75	E.W. 38" [illegible]
93	252.4	5 0 1	Y N	Y N	–/–/–	
94	26.6	3 0 0	Y N	Y N	4/25/75	[illegible] broadcast
95	83.7	5 0 8	Y N	Y N	Before –/70	
96	233.3	5 0 1	Y N	Y N	–/–/–	
97	74.5	5 0 5	Y N	Y N	Before –/70	
98	18.2	5 0 1	Y N	Y N	–/–/–	
99	295.2	5 0 1	Y N	Y N	–/–/–	
100	124.7	5 0 2	Y N	Y N	Before –/70	
101	23.3	2 0 0	Y N	Y N	5/25/–	E.W. 7" Unknown [illegible]
102	24.2	5 0 1	Y N	Y N	–/–/–	Grazed with 104 & 103
103	74.2	5 0 1	Y N	Y N	–/–/–	Grazed with 104 & 102
104	87.6	5 0 2	Y N	Y N	Before –/70	Grazed with 102 & 103
105	635.1	5 0 1	Y N	Y N	–/–/–	
106	31.8	5 0 2	Y N	Y N	Before –/70	
107	62.7	5 0 1	Y N	Y N	–/–/–	
108	54.2	5 0 2	Y N	Y N	Before –/70	
109	27.0	5 0 5	Y N	Y N	5/–/71	
110	99.6	6 0 7	Y N	Y N	"–/–/–	N.S. 28"
111	144.6	5 0 1	Y N	Y N	"–/–/–	
112	284.7	5 0 1	Y N	Y N	–/–/–	

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TEST SITE # 35 (HAND(2), S.D.)
INVENTORY OBSERVATION

GROUND TRUTH INVENTORY FORM

DATA RECORDED BETWEEN - 8/2?/75
AND - 8/26/75

LAND USE CROP CODES

100 SPRING WHEAT (GEN) CODE LIST ATTACHED
200 BARLEY (GEN)
201 LARKER
202 VANGUARD
203 BONANZA
204 DICKSON
205 PRIMUS
206 SHABET
207 PIROLINE
208 BETZES
209 ST. PIC
210 FERGUS
211 PARAGON
212 MENKA
213 CONQUEST
214 WISCONSIN
215 HECTOR
213 HYPANA
217 MORAVIAN
300 OATS (GEN)
301 RUSSELL
302 BASIN
303 KELSEY
304 HOUSEY
305 LODI
306 KINSEY
307 MAYNON
308 MISSION
400 WINTER WHEAT (GEN)
401 DAWN HARD NORTHERN
402 SCOUT
403 PARKER
404 EAGLE
405 APACHE
406 TRIUMPH
407 SATANTA
408 CENTURK
409 BISON
410 WANSER
411 MCCALL
412 WARRIOR
413 GAINES
414 NUGAINES
415 DAUCHAMP
416 MONO
417 SUNT
418 HAIDGER
419 ARTHUR
420 TASCOSA
421 STURDY
422 CONCHO
423 CAPROCK
424 EAGLE SCOUT
425 TRISPIKE
426 CHEYENNE
427 ALFALFA
428 WINOKA
500 GRASSES/PASTURE ETC.
600 OTHER CROPS (GEN)
601 RAPESEED
602 RYE
603 MUSTARD
604 FLAX (GEN)
605 NORALTA FLAX
606 REDWOOD FLAX
607 CORN
610 BUCKWHEAT
611 SUNFLOWERS
612 DRY BEANS
613 LENTILS
614 DRY PEAS
615 SUGAR BEETS
616 GRAIN SORGHUM
617 SOYBEANS
618 COTTON
700 SUMMER FALLOW
800 NON-AGRICULTURE
900 UNKNOWN CROPS

MAP REFERENCE # OF FIELD	ACREAGE	LAND USE CROP CODE	IRRIGATED	FERTILIZED	PLANTING DATE MONTH / DAY / YEAR	COMMENTS
113	83.1	504	Y N	Y N	— / — / —	
114	64.8	505	Y N	Y N	5 / — / 74	[illegible]
115	2.3	504	Y N	Y N	— / — / —	
116	372.2	501	Y N	Y N	— / — / —	
117	156.0	501	Y N	Y N	— / — / —	
118	44.4	607	Y N	Y N	5 / 16 / 75	E-W, 42"
119	26.6	505	Y N	Y N	5 / — / 70	
120	44.2	200	Y N	Y N	5 / 4 / 75	Kahanna, E-W, 7"
121	348.7	501	Y N	Y N	— / — / —	
122	42.8	504	Y N	Y N	— / — / —	
123	161.2	501	Y N	Y N	— / — / —	
124	26.6		Y N	Y N	6 / 3 / 75	Millet, N-S, 7"
125	27.1	500	Y N	Y N	6 / 3 / 75	S. Sudan, N-S, 7"
126	52.0	501	Y N	Y N	— / — / —	
127	20.6	508	Y N	Y N	Before / — / 70	
128	28.4	504	Y N	Y N	— / — / —	
129	45.0	504	Y N	Y N	5 / — / 71	
130	5.8	504	Y N	Y N	— / — / —	
131	52.7	505	Y N	Y N	Before / — / 70	
132	44.5	505	Y N	Y N	Before / — / 70	
133	34.6	502	Y N	Y N	Before / — / 70	
134	31.6	300	Y N	Y N	5 / 20 / 75	Kahanna, E-W, 7"
135	32.2	607	Y N	Y N	5 / 17 / 75	N-S 40"
136	67.3	504	Y N	Y N	— / — / —	
137	33.0	505	Y N	Y N	Before / — / 70	
138	245.0	504	Y N	Y N	— / — / —	
139	160.9	501	Y N	Y N	— / — / —	
140	34.6	508	Y N	Y N	5 / — / 70	

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TEST SITE # 35 (HAND(?)), S.D.)
INVENTORY OBSERVATION

GROUND TRUTH INVENTORY FORM

DATA RECORDED BETWEEN - 6/24/75 AND - 6/26/75

LAND USE CROP CODES

103 SPRING WHEAT (GEN)	211 PARAGON	306 KINSEY	410 WANSER	423 CAPRECK	606 REDWOOD FLAX
CODE LIST ATTACHED	212 [illegible]	307 [illegible]	411 MCCALL	424 EAGLE SCOUT	607 CORN
200 [illegible] (GEN)	213 CONQUEST	308 [illegible]	412 [illegible]	425 [illegible]	610 BUCKWHEAT
201 [illegible]	214 WISCONSIN	400 WINTER WHEAT (GEN)	413 GAINES	426 CHEYENNE	611 SUNFLOWERS
202 [illegible]	215 [illegible]	401 DARK HARD NORTHERN	414 [illegible]	427 [illegible]	612 DRY BEANS
203 [illegible]	216 [illegible]	402 SCOUT	415 [illegible]	428 [illegible]	613 LENTILS
204 [illegible]	217 [illegible]	403 PARKER	416 [illegible]	500 [illegible] S/PASTURE ETC.	614 DRY PEAS
205 [illegible]	300 [illegible] (GEN)	404 EAGLE	417 [illegible]	600 OTHER CROPS (GEN)	615 SUGAR BEETS
206 [illegible]	301 [illegible]	405 [illegible]	418 [illegible]	601 RAPESEED	616 GRAIN SORGHUM
207 [illegible]	302 [illegible]	406 TRIUMPH	419 [illegible]	602 RYE	617 SOYBEANS
208 [illegible]	303 [illegible]	407 SATANTA	420 [illegible]	603 MUSTARD	618 COTTON
209 [illegible]	304 [illegible]	408 CENTURK	421 STURDY	604 FLAX (GEN)	700 SUMMER FALLOW
210 [illegible]	305 [illegible]	409 BISON	422 CLOCHO	605 [illegible] FLAX	800 NON-AGRICULTURE
					900 UNKNOWN CROPS

MAP REFERENCE # OF FIELD	ACREAGE	LAND USE CROP CODE	IRRIGATED	FERTILIZED	PLANTING DATE MONTH DAY YEAR	COMMENTS
141	65.1	1 0 7	Y N	Y N	5 / 17 / 75	E.W., 4c"
142	14.2	5 0 8	Y N	Y N	Before / -- / 70	
143	35.0	5 0 5	Y N	Y N	5 / -- / 70	
144	11.5	5 0 4	Y N	Y N	-- / -- / --	
145	36.6	5 0 1	Y N	Y N	-- / -- / --	
146	31.x	5 0 8	Y N	Y N	Before / -- / 70	
147	14.9	5 0 5	Y N	Y N	Before / -- / 70	
148	513.1	5 0 1	Y N	Y N	-- / -- / --	
149	85.6	5 0 1	Y N	Y N	-- / -- / --	
150	53.3	5 0 8	Y N	Y N	Before / -- / 70	
151	11.2	3 0 0	Y N	Y N	5 / 4 / 75	Resident Unknown
152	5.0	3 0 0	Y N	Y N	5 / 4 / 75	Resident Unknown
153	86.4	5 0 1	Y N	Y N	-- / -- / --	
154	37.2	6 0 7	Y N	Y N	5 / 24 / 75	U.S., 4a"
155	24.0	3 0 0	Y N	Y N	5 / 6 / 75	[illegible], U.S., 6"
156	12.9	5 0 0	Y N	Y N	5 / 6 / 75	[illegible], U.S., 7"
157	3.1	5 0 4	Y N	Y N	-- / -- / --	
158	32.6	1 0 0	Y N	Y N	4 / 27 / 75	Bonanza, E.W., 6"
159	33.8	5 0 4	Y N	Y N	-- / -- / --	
160	11.5	7 0 0	Y N	Y N	-- / -- / --	
161	16.6	5 0 5	Y N	Y N	Before / -- / 70	
162	39.5	6 0 7	Y N	Y N	5 / 25 / 75	E.W., 4a"
163	32.2	5 0 5	Y N	Y N	-- / -- / --	
164	31.4	6 0 7	Y N	Y N	5 / 24 / 75	E.W., 4a"
165	24.4	5 2 1	Y N	Y N	-- / -- / --	
166	4.0	5 0 4	Y N	Y N	-- / -- / --	
167	5.5	1 [illegible] 0	Y N	Y N	4 / 24 / 75	[illegible], E.W., 6"
168	108.0	5 0 1	Y N	Y N	-- / -- / --	

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TEST SITE # 35 (HAND(?), S.D.)
INVENTORY OBSERVATION

GROUND TRUTH INVENTORY FORM

DATA RECORDED BETWEEN AND 6/26/75
6/26/75

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LAND USE CROP CODES

100 SPRING WHEAT (GEN)
CODE LIST ATTACHED
200 BARLEY (GEN)
201 LARKER
202 VANGUARD
203 [illegible]
204 DICKSON
205 [illegible]
206 SHABET
207 PIROLINE
208 BETZES
209 STEPTOE
210 FERGUS
211 PARAGON
212 PERTA
213 CONQUEST
214 WISCONSIN
215 [illegible]
216 HYPANA
217 [illegible]
300 OATS (GEN)
301 RUSSELL
302 BASIN
303 KELSEY
304 [illegible]
305 LODI
306 KINSEY
307 MANHOM
308 [illegible]
400 WINTER WHEAT (GEN)
401 DARK HARD NORTHERN
402 SCOUT
403 PARKER
404 EAGLE
405 APACHE
406 TRIUMPH
407 SATANTA
408 CENTURK
409 BISON
410 WANSER
411 PECAIL
412 [illegible]
413 GAINES
414 NUGAINES
415 BEAUCHAMP
416 MOHO
417 AUNT
418 BRIDGER
419 ARTHUR
420 TASCOSA
421 STURDY
422 CONCHO
423 CAPROCK
424 EAGLE SCOUT
425 [illegible]
426 CHEYENNE
427 [illegible]
428 [illegible]
500 GRASSES/PASTURE ETC.
600 OTHER CROPS (GEN)
601 RAPESEED
602 RYE
603 MUSTARD
604 FLAX (GEN)
605 NORALTA FLAX
606 REDWOOD FLAX
607 CORN
610 BUCKWHEAT
611 SUNFLOWERS
612 DRY BEANS
613 LENTILS
614 DRY PEAS
615 SUGAR BEETS
616 GRAIN SORGHUM
617 SOYBEANS
618 COTTON
700 SUMMER FALLOW
800 NON-AGRICULTURE
900 UNKNOWN CROPS

MAP REFERENCE # OF FIELD	ACREAGE	LAND USE CROP CODE	IRRIGATED	FERTILIZED	PLANTING DATE MONTH DAY YEAR	COMMENTS
169	51.9	502	Y N	Y N	Before - - / 70	Planted with 170
170	121.7	501	Y N	Y N	- / - / -	
171	46.4	503	Y N	Y N	Before - - / 70	
172	21.1	607	Y N	Y N	5 / 27 / 75	E.W. 40"
173	64.1	501	Y N	Y N	- / - / -	
174	184.4	501	Y N	Y N	- / - / -	
175	34.4	504	Y N	Y N	- / - / -	
176	26.9	100	Y N	Y N	5 / 4 / 75	E.W. 6" Unknown, tall bearded
177	29.5	505	Y N	Y N	Before - - / 70	
178	26.6	607	Y N	Y N	6 / 4 / 75	E.W. 40"
179	15.1	607	Y N	Y N	5 / 31 / 75	E.W. 42"
180	14.9	800	Y N	Y N	- / - / -	[illegible]
181	16.1	505	Y N	Y N	Before - - / 70	
182	23.5	100	Y N	Y N	5 / 2 / 75	Unknown, E.W. 6" Tall bearded
183	2.6	100	Y N	Y N	4 / 30 / 75	Unknown, E.W. 6" tall bearded
184	35.7	607	Y N	Y N	5 / 28 / 75	N.S. 38" [illegible]
185	37.3	504	Y N	Y N	- / - / -	
186	18.9	501	Y N	Y N	- / - / -	
187	28.1	505	Y N	Y N	5 / - / 71	
188	14.7	502	Y N	Y N	Before - - / 70	
189	18.9	201	Y N	Y N	5 / 6 / 75	N.S. 7"
190	27.0	300	Y N	Y N	5 / 6 / 75	Curasson(?), N.S. 7"
191	30.0	300	Y N	Y N	5 / 6 / 75	Fr[illegible], N.S. 7"
192	42.9	300	Y N	Y N	5 / 9 / 75	[illegible] fertilized /100 = 0-30-0
193	15.9	504	Y N	Y N	- / - / -	
194	16.0	607	Y N	Y N	5 / 20 / 75	E.W. 38"
195	60.2	501	Y N	Y N	- / - / -	
196	7.3	607	Y N	Y N	5 / 21 / 75	E.W. 40"

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TEST SITE # 35 (HAND(2), S.D.)
INVENTORY OBSERVATION

GROUND TRUTH INVENTORY FORM

DATA RECORDED BETWEEN AND - 8/24/75 - 8/26/75

LAND USE CROP CODES

100 SPRING WHEAT (GEN) CODE LIST ATTACHED	211 PARAGON	306 KINSEY	410 HANSER	423 CAPROCK	609 REDWOOD FLAX
200 BARLEY (GEN)	212 MEPTA	307 MARMON	411 MCCALL	424 EAGLE SCOUT	607 CORN
201 LARKER	213 CONQUEST	308 MISSION	412 NEEVER	425 TRAPPER	610 BUCKWHEAT
202 VANGUARD	214 WISCONSIN	400 WINTER WHEAT (GEN)	413 GAINES	426 CHEYENNE	611 SUNFLOWERS
203 [illegible]	215 FELTOR	401 DARK HARD NORTHERN	414 NUGAINES	427 WINALTA	612 DRY BEANS
204 [illegible]	216 [illegible]	402 SCOUT	415 [illegible]	428 [illegible]	613 LENTILS
205 [illegible]	217 MORAVIAN	403 PARKER	416 [illegible]	500 GRASSES/PASTURE ETC.	614 DRY PEAS
206 [illegible]	300 OATS (GEN)	404 EAGLE	417 [illegible]	600 OTHER CROPS (GEN)	615 SUGAR BEETS
207 PIRILINE	301 [illegible]	405 APACHE	418 [illegible]	601 RAPESEED	616 GRAIN SORGHUM
208 [illegible]	302 [illegible]	406 TRIUMPH	419 [illegible]	602 RYE	617 SOYBEANS
209 [illegible]	303 KELSEY	407 SATANTA	420 TASCOSA	603 MUSTARD	618 COTTON
210 [illegible]	304 [illegible]	408 CENTURK	421 STURDY	604 FLAX (GEN)	700 SUMMER FALLOW
	305 [illegible]	409 BISON	422 CONCHO	605 NORALTA FLAX	800 NON-AGRICULTURE
					900 UNKNOWN CROPS

MAP REFERENCE # OF FIELD	ACREAGE	LAND USE CROP CODE	IRRIGATED	FERTILIZED	PLANTING DATE MONTH DAY YEAR	COMMENTS
197	42.8	607	Y N	Y N	5/21/75	
198	52.2	505	Y N	Y N	5/--/70	
199	27.4	501	Y N	Y N	—/—/—	
200	25.2	4[illegible]0	Y N	Y N	4/29/75	Sheridan, N.S., 7"
201	27.5	[illegible]07	Y N	Y N	5/18/75	Ed, 36"
202	23.3	504	Y N	Y N	—/—/—	
203	37.4	400	Y N	Y N	5/-[illegible]/75	[illegible] N.S., 7" tall bearded
204	59.4	400	Y N	Y N	5/-2/75	[illegible] N.S., 7" tall bearded
205	44.6	607	Y N	Y N	6/25/75	N.S., 30"
206	22.3	607	Y N	Y N	5/20/75	
207	20.[illegible]	50[illegible]	Y N	Y N	Before --/70	Alfalfa pastured with 208
208	102.2	503	Y N	Y N	Before --/70	
209	21.5	502	Y N	Y N	Before --/70	
210	41.7	411	Y N	Y N	4/25/75	N.S. 6", 100# 0-30-0
211	42.7	607	Y N	Y N	5/20/75	N.S. 32"
212	25.5	300	Y N	Y N	5/-9/75	[illegible] N.S., 6", 100# 0-30-0
213	29.0	505	Y N	Y N	5/--/72	
214	91.4	500	Y N	Y N	5/15/75	[illegible]
215	27.3	505	Y N	Y N	5/--/70	
216	49.1	607	Y N	Y N	5/16/75	E.W. 28", 100# 29-14-0
217	18.1	411	Y N	Y N	5/-5/75	E.W., 7" Bearded
218	86.6	607	Y N	Y N	5/16/75	E.W. 38"
219	19.5	411	Y N	Y N	5/-5/75	E.W., 7" Bearded
220	44.4	400	Y N	Y N	5/-5/75	E.W., 7" Bearded [illegible]
221	32.3	505	Y N	Y N	5/--/71	
222	49.7	607	Y N	Y N	5/15/75	E.W., 38"
223	24.6	505	Y N	Y N	Before --/70	
224	40.0	505	Y N	Y N	Before --/70	

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TEST SITE # 35 ([illegible]), S.D.)
INVENTORY OBSERVATIONS

GROUND TRUTH INVENTORY FORM

DATA RECORDED BETWEEN - 6/24/75
AND - 6/26/75

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LAND USE CROP CODES

100 SPRING WHEAT (GEN)
CODE LIST ATTACHED
200 BARLEY (GEN)
201 LARKER
202 [illegible]
203 [illegible]
204 DICKSON
205 [illegible]
206 SHABET
207 [illegible]
208 [illegible]
209 STEPTOE
210 FEAGLS
211 PARAGON
212 [illegible]
213 CONQUEST
214 WIS. [illegible]
215 HECTOR
216 [illegible]
217 [illegible]
300 OATS (GEN)
301 RUSSELL
302 [illegible]
303 KELSEY
304 [illegible]
305 LODI
306 KINSEY
307 [illegible]
308 MISSION
400 WINTER WHEAT (GEN)
401 DARK HARD NORTHERN
402 SCOUT
403 PARKER
404 [illegible]
405 APACHE
406 TRIUMPH
407 SATANTA
408 CENTURK
409 BISON
410 HANSEN
411 MCCALL
412 [illegible]
413 GAINES
414 [illegible]
415 [illegible]
416 [illegible]
417 [illegible]
418 [illegible]
419 ANTHON
420 TASCOSA
421 STURDY
422 CONCHO
423 CAPROCK
424 EAGLE SCOUT
425 TRAPPER
426 CHEYENNE
427 [illegible]
428 [illegible]
500 GRASSES/PASTURE ETC.
600 OTHER CROPS (GEN)
601 RAPESEED
602 RYE
603 MUSTARD
604 FLAX (GEN)
605 [illegible] FLAX
606 REDWOOD FLAX
607 CORN
610 BUCKWHEAT
611 SUNFLOWERS
612 DRY BEANS
613 LENTILS
614 DRY PEAS
615 SUGAR BEETS
616 GRAIN SORGHUM
617 SOYBEANS
618 COTTON
700 SUMMER FALLOW
800 NON-AGRICULTURE
900 UNKNOWN CROPS

MAP REFERENCE # OF FIELD	ACREAGE	LAND USE CROP CODE	IRRIGATED	FERTILIZED	PLANTING DATE MONTH DAY YEAR	COMMENTS
225	32.6	607	Y N	Y N	5/22/75	E.W. 25"
226	73.0	200	Y N	Y N	5/8/75	E.W. 7", [illegible]
227	117.6	501	Y N	Y N	—/—/—	
228	34.4	607	Y N	Y N	5/16/75	E.W. 38"
229	70.8	501	Y N	Y N	—/—/—	
230	44.1	505	Y N	Y N	Before / /70	
231	66.5	505	Y N	Y N	5/ /73	
232	16.3	300	Y N	Y N	4/30/75	N.S. 7", [illegible]
233	476.9	501	Y N	Y N	—/—/—	
234	43.4	505	Y N	Y N	Before / /70	
235	92.2	504	Y N	Y N	—/—/—	
236	47.5	100	Y N	Y N	4/25/75	[illegible] N.S. 7", [illegible]
237	29.8	201	Y N	Y N	5/1/75	E.W. 7" See Comments
238	31.9	505	Y N	Y N	5/ /74	
239	30.3	607	Y N	Y N	5/14/75	E.W. 42"
240	29.9	100	Y N	Y N	4/23/75	E.W. 7" [illegible]
241	30.5	607	Y N	Y N	5/15/75	E.W. 42"
242	23.1	120	Y N	Y N	4/25/75	N.S. 6"
243	19.1	300	Y N	Y N	4/30/75	[illegible] Barley with Oats
244	57.6	300	Y N	Y N	4/30/75	[illegible] Barley with Oats
245	42.8	120	Y N	Y N	4/26/	N.S. 6"
246	71.2	505	Y N	Y N	5/ /73	
247	76.1	300	Y N	Y N	5/12/75	E.W. 7" Burnette
248	35.5	111	Y N	Y N	5/5/75	E.W. 7"
249	559.8	501	Y N	Y N	—/—/—	
250	42.2	502	Y N	Y N	Before / /70	Part in with part of 249
251	45.6	502	Y N	Y N	Before / /70	Contact with 252
252	5.4	502	Y N	Y N	Before / /70	Contact with 252

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GROUND TRUTH INVENTORY FORM

TEST SITE # 35 (HAND(?)(?), S.D.)
INVENTORY OBSERVATION

DATA RECORDED BETWEEN 5/28/75 AND 5/26/75

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LAND USE CROP CODES

100 SPRING WHEAT (GEN) CLUE LIST ATTACHED
200 BARLEY (GEN)
201 [illegible]
202 [illegible]
203 [illegible]
204 [illegible]
205 [illegible]
206 [illegible]
207 [illegible]
208 [illegible]
209 [illegible]
210 FERGUS
211 PARAGON
212 [illegible]
213 CONQUEST
214 WISCONSIN
215 [illegible]
216 [illegible]
217 [illegible]
300 OATS (GEN)
301 RUSSELL
302 [illegible]
303 [illegible]
304 [illegible]
305 LODI
306 KINSEY
307 [illegible]
308 MISSION
400 WINTER WHEAT (GEN)
401 HARD RED WINTER? HARD NORTHERN
402 SCOUT
403 [illegible]
404 [illegible]
405 APACHE
406 TRIUMPH
407 SATANTA
408 CENTURK
409 BISON
410 [illegible]
411 MCCALL
412 [illegible]
413 GAINES
414 [illegible]
415 [illegible]
416 [illegible]
417 [illegible]
418 [illegible]
419 ARTHUR
420 TASCOSA
421 STURDY
422 CONCHO
423 CAPROCK
424 EAGLE SCOUT
425 [illegible]
426 CHEYENNE
427 [illegible]
428 [illegible]
500 GRASSES/PASTURE ETC.
600 OTHER CROPS (GEN)
601 RAPESEED
602 RYE
603 MUSTARD
604 FLAX (GEN)
605 NORALTA FLAX
606 REDWOOD FLAX
607 CORN
610 BUCKWHEAT
611 SUNFLOWERS
612 DRY BEANS
613 LENTILS
614 DRY PEAS
615 SUGAR BEETS
616 GRAIN SORGHUM
617 SOYBEANS
618 COTTON
700 SUMMER FALLOW
800 NON-AGRICULTURE
900 UNKNOWN CROPS

MAP REFERENCE # OF FIELD	ACREAGE	LAND USE CROP CODE	IRRIGATED	FERTILIZED	PLANTING DATE MONTH DAY YEAR	COMMENTS
253	332.6	5 0 1	Y N	Y N	— / — / —	
254	8.0	1 [illegible] 0	Y N	Y N	5 / 4 / 75	[illegible], 6",
255	23.4	3 0 0	Y N	Y N	5 / 4 / 75	[illegible], Early 6", Some Barley & Wild Oats
256	9.6	1 0 0	Y N	Y N	5 / 4 / 75	[illegible]
257	5.5	5 0 8	Y N	Y N	Before / / 70	
258	22.7	6 0 7	Y N	Y N	5 / 16 / 75	[illegible]
259	26.9	3 0 0	Y N	Y N	5 / 4 / 75	[illegible], Some Barley
260	17.8	5 0 8	Y N	Y N	5 / / 70	
261	21.0	5 0 4	Y N	Y N	Before / / 70	
262	34.2	5 0 4	Y N	Y N	Before / / 70	
263	41.7	1 0 0	Y N	Y N	5 / 2 / 75	[illegible], E.W., 7"
264	35.2	5 0 8	Y N	Y N	Before / / 70	
265	15.0	5 0 3	Y N	Y N	Before / / 70	
266	27.1	1 [illegible] 0	Y N	Y N	5 / 1 / 75	[illegible], 7" [illegible]
267	12.7	5 0 2	Y N	Y N	Before / / 70	
268	48.6	5 0 2	Y N	Y N	Before / / 70	
269	6.8	5 0 4	Y N	Y N	— / — / —	
270	63.0	1 [illegible] 0	Y N	Y N	5 / 1 / 75	Bonanza, E.W., 6"
271	8.[illegible]	5 0 [illegible]	Y N	Y N	— / — / —	
272	9.7	5 0 4	Y N	Y N	— / — / —	
273	.9	8 0 0	Y N	Y N	— / — / —	[illegible] 6/26/75
274	56.4	5 0 1	Y N	Y N	— / — / —	
275	228.3	5 0 1	Y N	Y N	— / — / —	
276			Y N	Y N	/ /	
277			Y N	Y N	/ /	
278			Y N	Y N	/ /	
279			Y N	Y N	/ /	
280			Y N	Y N	/ /	

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COMMENTS (UNUSUAL CONDITIONS, MISCELLANEOUS INFORMATION, QUESTIONS, PROBLEMS, WRITING SPACE, ECT.)

Field # 15 - All alfalfa now. South of Corn field # 13 was planted before 1970. Rest was planted in 1970 and 1971

504 Classification includes Native & Tame grass for hay. If there is a planting date it is tame grass. If just dashes it is Native grass for hay.

Field - 237 - 29.8 is total field acreage. Includes sod waterway of 3.5 acres. Barley is nurse crop with new seeding of grass and Alfalfa. Next year the field would be all grass & alfalfa for hay.

Appendix B

Data Set A (Reston Mirrors)

Resampled at 1:1 Pixel Aspect Ratio

Section B.1 SUMMARY OF EFFORT

This appendix contains results of additional processing requested by personnel at the NASA Goddard Space Flight Center during their review of the draft of the body of this report. The additional processing consisted of resampling one band of the original data of the Reston mirrors of Data Set A to produce arrays with output pixels having a 1:1 aspect ratio. The corresponding arrays presented earlier in this report have aspect ratios of 1.4:1 (approximate ground distance per pixel of 57.2 meters horizontally by 79.0 meter vertically).

The resampling to produce the desired arrays was performed using both the nearest neighbor and cubic convolution resampling algorithms and was done so that output pixels represent 50.8 meters square. The results were plotted on film using 100µm square spot, contact printed (Figure B.1), and enlarged by 10X (Figures B.2 and B.3). Pixel value printouts of the area immediately surrounding the mirrors in the two resampled versions were generated and are presented in Figures B.4 and B.5.

Also included in this appendix are results which compare the spatial frequency content of 1:1 data with that of 1.4:1 data. These results are based on power spectra of the resampled versions of the Reston mirrors area and were generated under funding from IBM's Internal Research and Development (IRAD) program in digital image processing. The method of computing the spectra was identical to that done for data set B in the body of this report. For all cases in this appendix, the spectra were averaged over 64 lines.

Figures B.6 through B.25 present pairs of plots. The first plot of each pair is that of a line which passes through the lower right (southeastern) mirror. The second plot of each pair is a power spectrum averaged over 64 lines of data centered on the line that is plotted. The plotted line should not be interpreted as being typical of all 64 lines used to compute the spectrum. Because it does contain the mirror spike, the plotted line may have more power in the high frequencies. All plots are based on data representing the same ground area. Because the number of pixels representing that ground area varies with pixel scale and aspect ratio, the plots vary in size. One pair of plots is presented for horizontal lines, and one for vertical lines for each of the following versions of the data: original, nearest neighbor 1.4:1, nearest neighbor 1:1, cubic convolution 1.4:1, and cubic convolution 1:1.

Section B.2 EVALUATION AND CONCLUSIONS

Inspection of the generated data led to the following conclusions:

1. The spreading and overshoot properties of the cubic convolution resampling algorithm noticed in the 1.4:1 data in the main report are clearly present in the 1:1 data in this appendix. The spreading is seen in the southeastern mirror, which affects six horizontal lines in the cubic convolution 1:1 output data (Figure B.3), although it is present in only one horizontal line in the original data. The overshoot is seen in the black borders above and below the mirrors. The intensity values assigned to certain pixels surrounding the mirrors are, for nearest neighbor data, in the range 13-15. Due to the overshoot, the same pixels in cubic convolution are in the range 1-4.

2. The power spectrum plots show that there is significantly more high frequency power in the vertical direction than in the horizontal direction in all cases. This is true both of the spectra in this appendix and of those in the body of the report. The greater high frequency power in the vertical direction is to be expected because of the horizontal oversampling and because of the fact that, vertically, detector-to-detector differences would appear as high-frequency noise. Because of this result, and the fact that cubic convolution is a mild low pass filter, it is not surprising that the attenuation of the highest frequencies is greater in the vertical direction (a factor of about 4 or 5) than it is in the horizontal direction (a factor of less than 2) when comparing the 1.4:1 cubic convolution data to the original.

   A comparison of the spectra generated from original, nearest neighbor 1:1, and nearest neighbor 1.4:1 data shows that the power contained in a given spatial frequency is approximately the same in the three cases. The 1:1 data results in a better estimate of the spectrum. It has somewhat less power in the high frequencies because, with the increased sampling rate used to achieve the 1:1 aspect ratio, the folding frequency is moved out in the spectrum and the components folded back in have less power.

   A similar situation is noticed comparing the cubic convolution 1.4:1 and 1:1 spectra. Low frequency power terms are very similar, but, in the 1:1 case where the sampling was done more densely, the power in the high frequency terms is slightly lower than the power in the corresponding 1.4:1 terms due to the lack of additional folding.

   In a comparison of the nearest neighbor 1:1 spectra with the cubic convolution 1:1 spectra, the greater power in the high frequency terms of the former is indicative of the fact that nearest neighbor does not filter out the high frequency mirror image components of the spectrum which appear due to the original sampling operation.

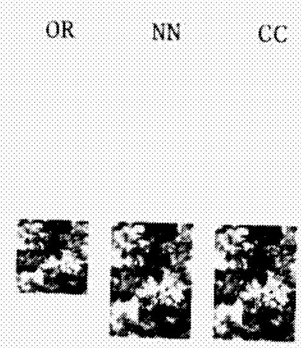

Figure B.1. [illegible]tact Print of Reston Mirrors, Pixel Aspect Ratio 1:1 in Resampled Data, OR, NN, CC-1800-15081-5

One pixel = 50.8 meters square
Approximate scale of image is 1:50,000

Figure F.2. 10X Enlargement of Reston Mirrors,
Pixel Aspect Ratio 1:1, NN-1800-15081-5

One pixel = 50.8 meters square
Approximate scale of image is 1:50,000

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Figure B.3. 10X Enlargement of Reston Mirrors,
Pixel Aspect Ratio 1:1, CC-1800-15081-5

PIXEL INTENSITY VALUES AROUND RESTON MIRRORS. 1:1 PIXELS. NN-1800-15081-5

PRINTOUT OF INTENSITY VALUE OF PIXELS SURROUNDING SAMPLE 59, LINE 79

	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
LINE 69	13	13	13	13	12	16	17	15	13	13	13	13	13	13	13	13	13	13	13	13
LINE 70	12	12	14	14	14	15	16	14	16	16	16	14	14	14	14	14	14	12	12	14
LINE 71	13	12	14	14	14	15	16	14	16	16	16	14	14	14	14	14	14	12	12	14
LINE 72	13	13	14	13	14	14	14	14	14	13	14	15	20	20	21	20	16	13	13	14
LINE 73	14	15	15	16	16	16	25	45	23	14	14	12	12	12	14	16	19	18	15	14
LINE 74	14	15	15	16	16	25	25	45	23	14	14	12	12	14	14	16	19	18	15	14
LINE 75	14	14	13	14	20	24	24	27	31	26	24	21	13	12	12	13	13	13	15	18
LINE 76	14	14	14	14	15	20	23	23	29	35	29	21	14	14	13	13	13	13	15	18
LINE 77	14	14	14	14	15	20	23	23	29	35	29	21	14	14	14	14	12	14	12	12
LINE 78	21	21	17	19	112	71	23	26	28	28	30	30	21	15	13	13	13	13	12	12
LINE 79	16	15	15	16	29	29	23	28	26	28	30	30	21	15	13	13	13	13	12	12
LINE 80	15	15	15	18	29	29	24	24	24	24	25	26	22	15	12	12	14	14	14	14
LINE 81	19	19	19	19	19	16	20	21	21	21	25	25	45	127	127	98	25	25	15	14
LINE 82	19	19	19	19	19	16	20	21	21	25	25	25	45	127	127	98	25	15	15	14
LINE 83	23	19	19	19	23	25	28	25	24	24	24	24	25	26	24	16	14	15	15	19
LINE 84	16	26	23	23	16	18	16	24	27	24	24	24	20	21	18	18	20	20	23	19
LINE 85	16	26	23	23	16	18	16	24	27	24	24	24	20	21	16	18	20	20	23	23
LINE 86	17	27	21	17	17	27	23	16	17	23	21	24	24	27	28	23	24	21	21	23
LINE 87	28	25	21	25	25	51	47	16	21	24	24	25	24	27	28	23	24	21	21	23
LINE 88	28	25	21	25	51	51	47	16	21	24	24	25	25	25	25	21	23	25	24	23

Figure B.4 Pixel Value Printouts around Reston Mirrors, Pixel Aspect Ratio 1:1, NN-1800-15081-5

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PIXEL INTENSITY VALUES AROUND RESTON MIRRORS. 1:1 PIXELS. CC-1800-15081-5

PRINTOUT OF INTENSITY VALUES OF PIXELS SURROUNDING SAMPLE 59, LINE 79

		49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
LINE	69	13	13	13	13	13	17	17	15	14	13	13	13	13	13	13	13	13	13	13	13
LINE	70	12	12	13	14	14	16	16	14	15	16	16	15	13	13	13	13	13	12	12	13
LINE	71	12	12	13	14	14	14	13	11	15	15	16	15	15	17	17	16	15	12	11	13
LINE	72	13	13	14	14	13	14	15	15	14	13	14	14	18	21	21	19	16	13	12	14
LINE	73	14	15	15	15	14	16	29	36	17	12	12	12	14	17	18	19	19	17	15	14
LINE	74	14	15	14	15	16	20	36	43	24	17	17	15	12	11	13	16	19	18	16	15
LINE	75	14	14	13	13	16	23	26	30	30	24	23	21	15	11	12	14	14	14	15	18
LINE	76	13	13	13	14	4	8	19	27	33	33	28	22	14	12	13	13	12	13	14	16
LINE	77	16	16	15	14	39	39	25	23	32	35	29	23	16	14	14	13	13	14	12	12
LINE	78	21	20	15	20	102	66	35	20	30	30	30	28	21	16	14	13	13	13	11	11
LINE	79	19	16	14	24	79	67	32	22	26	26	29	30	21	7	1	3	9	13	13	13
LINE	80	15	15	16	16	18	22	24	23	23	24	26	27	23	20	16	13	13	14	14	14
LINE	81	16	18	19	19	16	16	19	21	21	23	25	27	48	103	107	94	44	12	13	13
LINE	82	22	21	18	19	20	19	23	23	21	23	23	25	56	116	117	102	45	11	14	15
LINE	83	23	21	19	20	24	25	28	26	24	24	24	24	28	35	33	26	17	13	16	18
LINE	84	18	22	24	20	16	19	20	25	28	25	24	23	17	11	8	7	13	17	20	21
LINE	85	14	24	27	18	15	18	15	21	24	24	24	22	20	21	19	19	21	21	22	22
LINE	86	17	26	24	17	20	26	26	16	17	22	22	22	25	27	26	22	24	21	21	22
LINE	87	25	26	21	17	33	49	34	13	18	23	23	24	26	28	27	22	24	23	22	23
LINE	88	26	25	22	23	41	54	36	13	21	24	24	25	25	25	23	21	23	25	25	24

Figure B.5 Pixel Value Printouts around Reston Mirrors, Pixel Aspect Ratio 1:1, CC-1800-15081-5

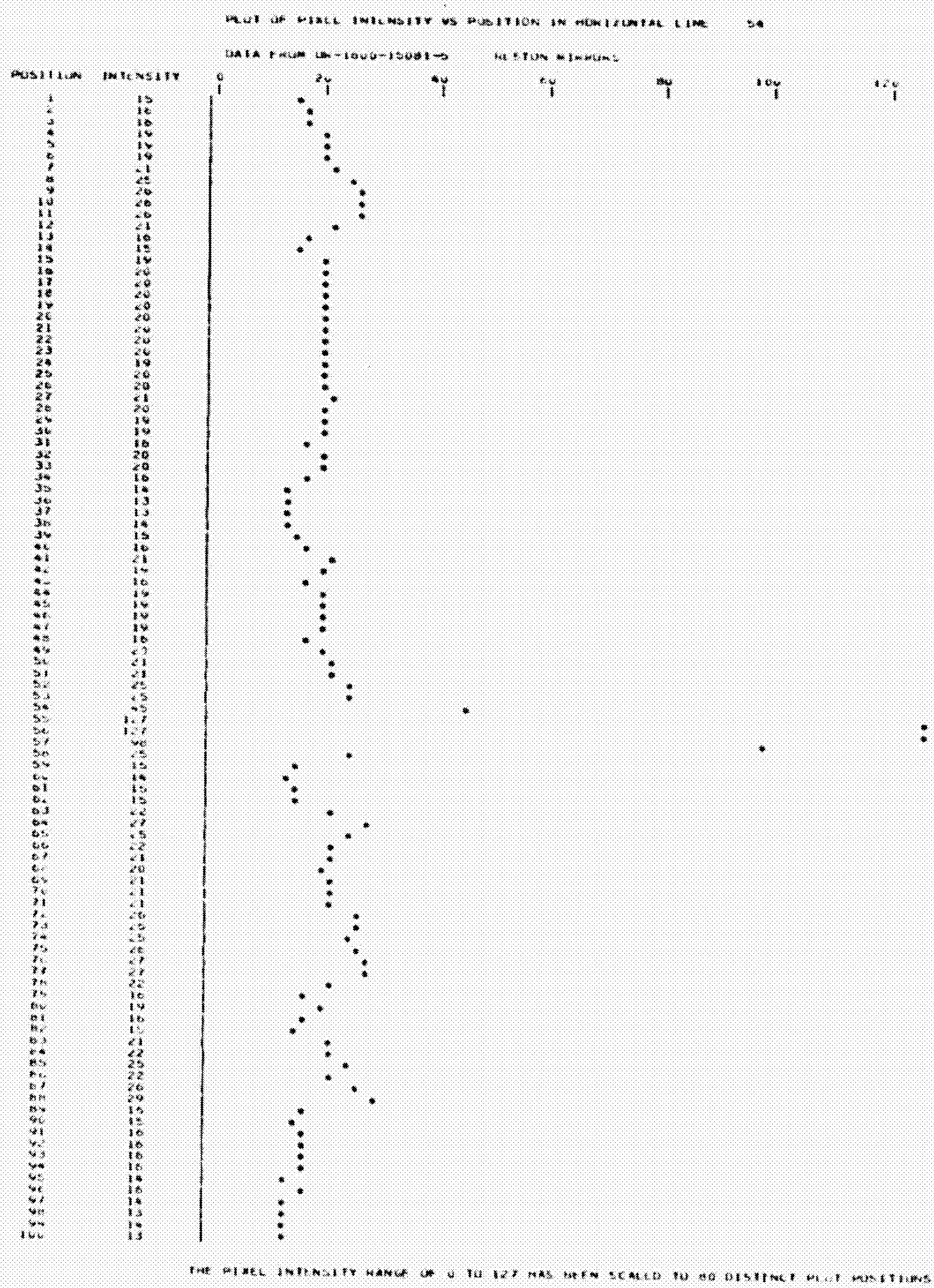

Figure B.6 Plot of Horizontal Line through Reston Mirrors, OR-1800-15081-5

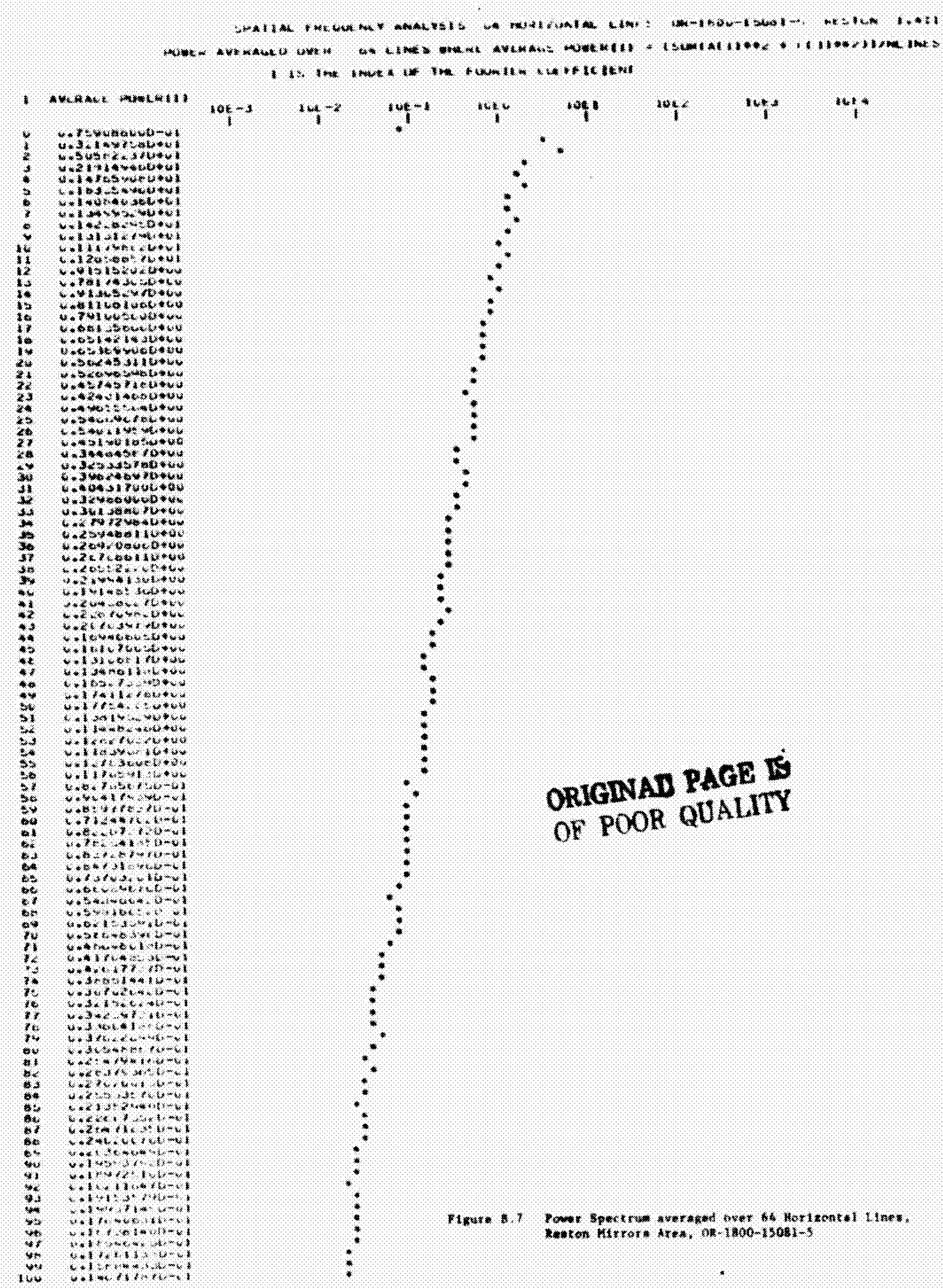

Figure 8.7 Power Spectrum averaged over 64 Horizontal Lines, Reston Mirrors Area, OR-1800-15081-5

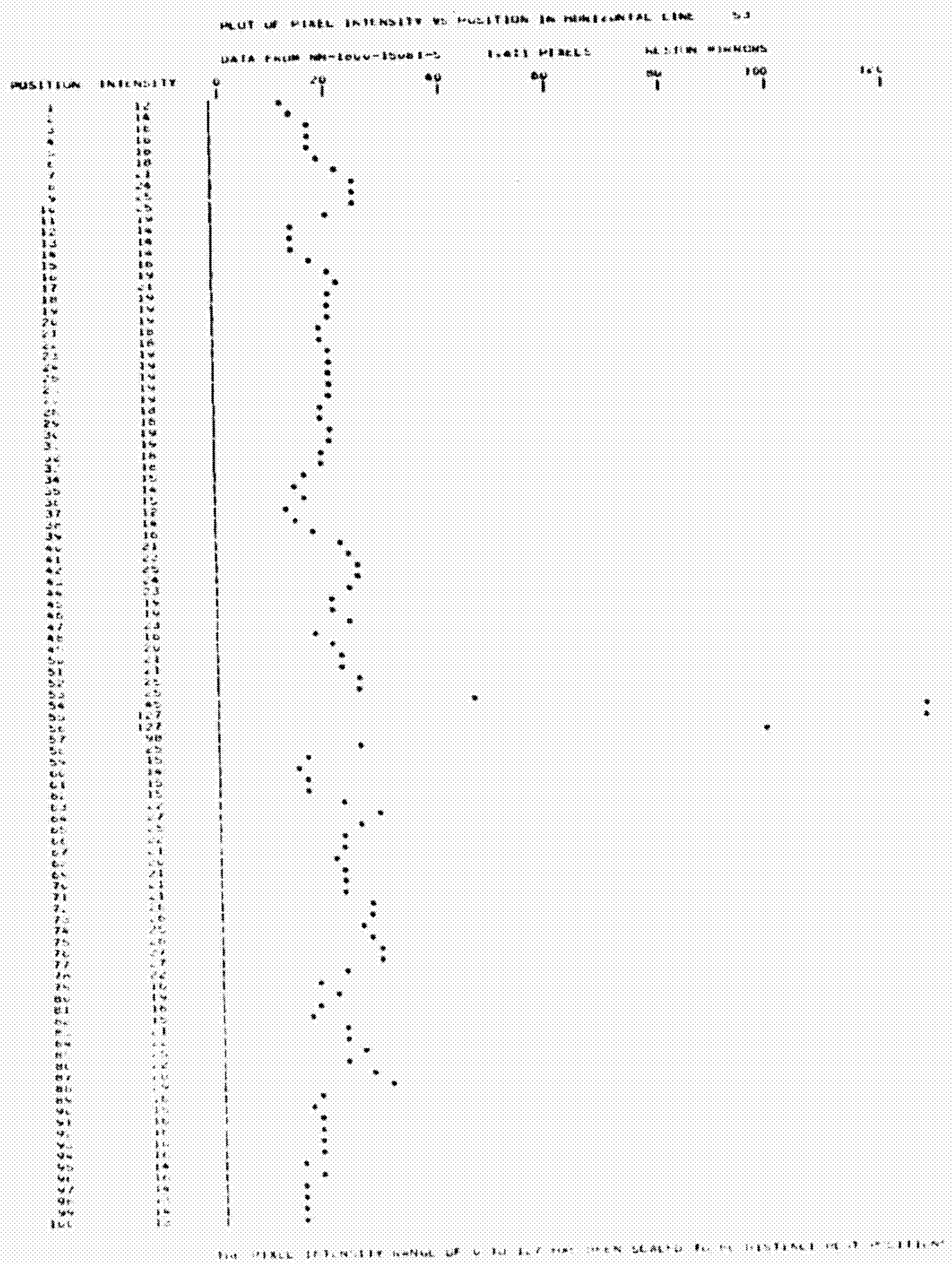

Figure B.8 Plot of Horizontal Line through Keeton Mirrors, NH-1800-15081-5, Resampled at 1.4:1

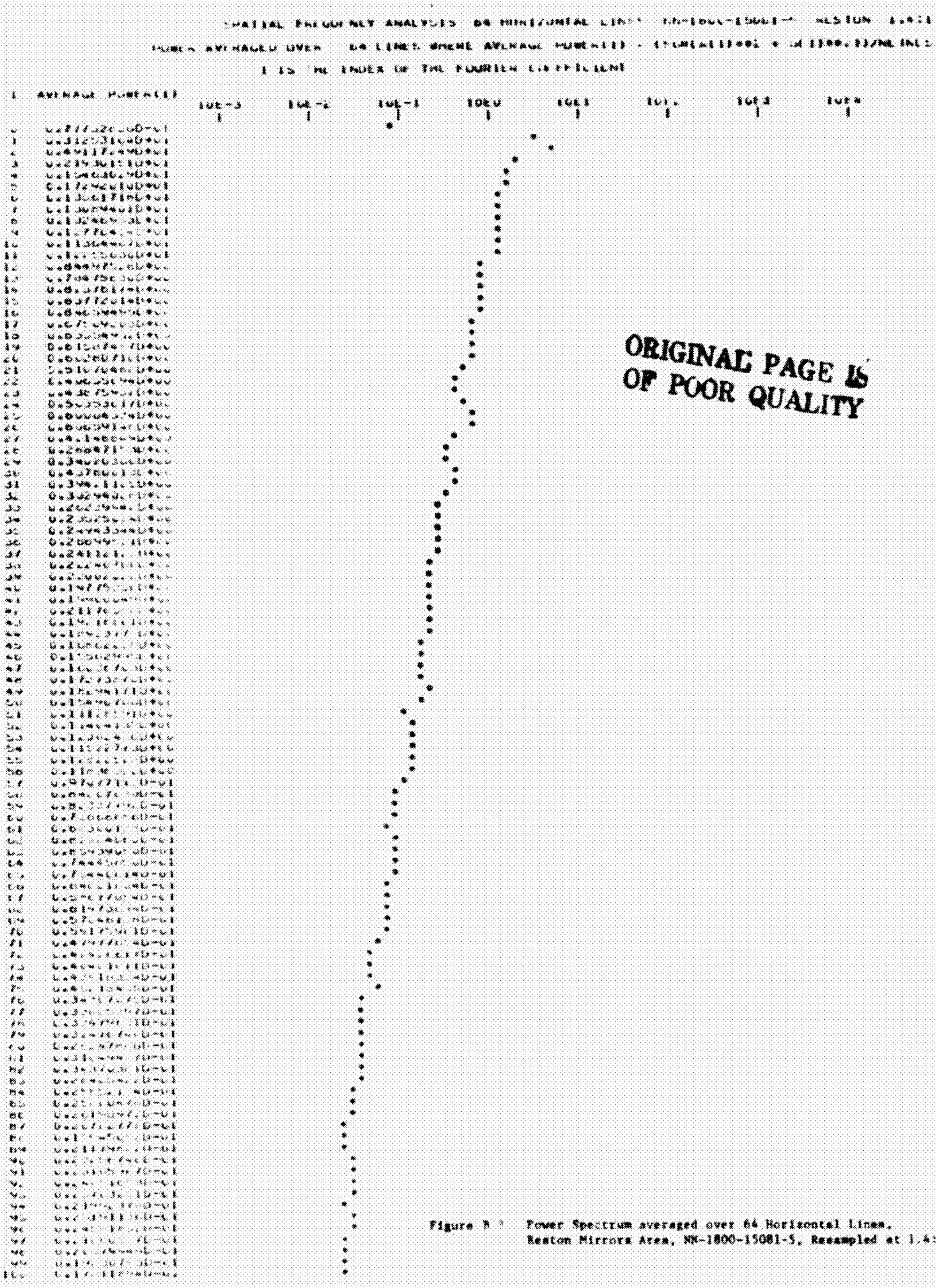

Figure B-? Power Spectrum averaged over 64 Horizontal Lines, Reston Mirrors Area, NN-1800-15081-5, Resampled at 1.4:1

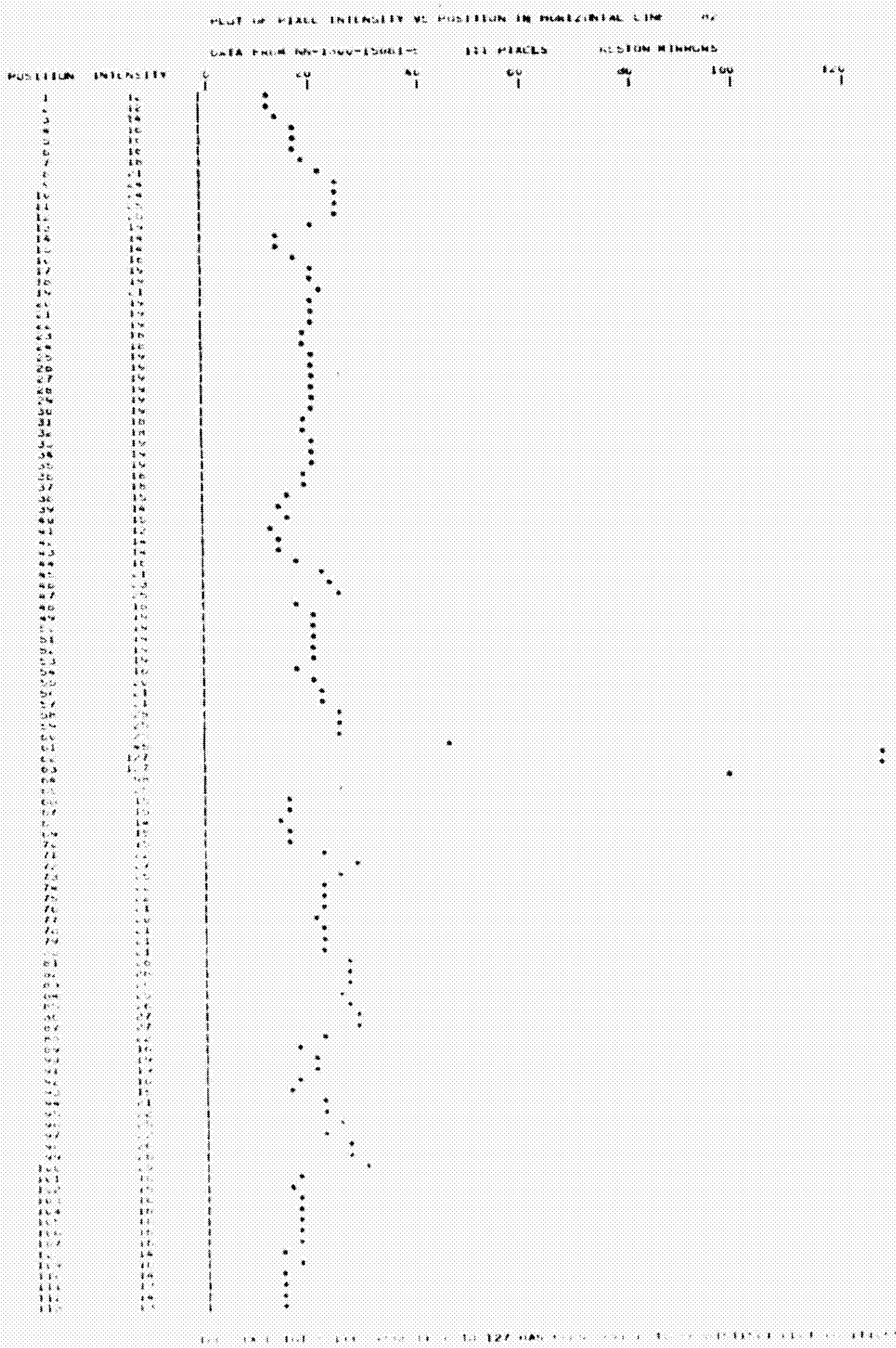

Figure B.10 Plot of Horizontal Line through Reston Mirrors, NN-1800-150B1-5, Resampled at 1:1

SPATIAL FREQUENCY ANALYSIS 64 HORIZONTAL LINES NN-1800-15081-5 RESTON 1:1

POWER AVERAGED OVER 64 LINES WHERE AVERAGE POWER(I) = (SUM(A(I)**2 + (Z(I)**2))/NLINES

I IS THE INDEX OF THE FOURIER COEFFICIENT

I AVERAGE POWER(I)

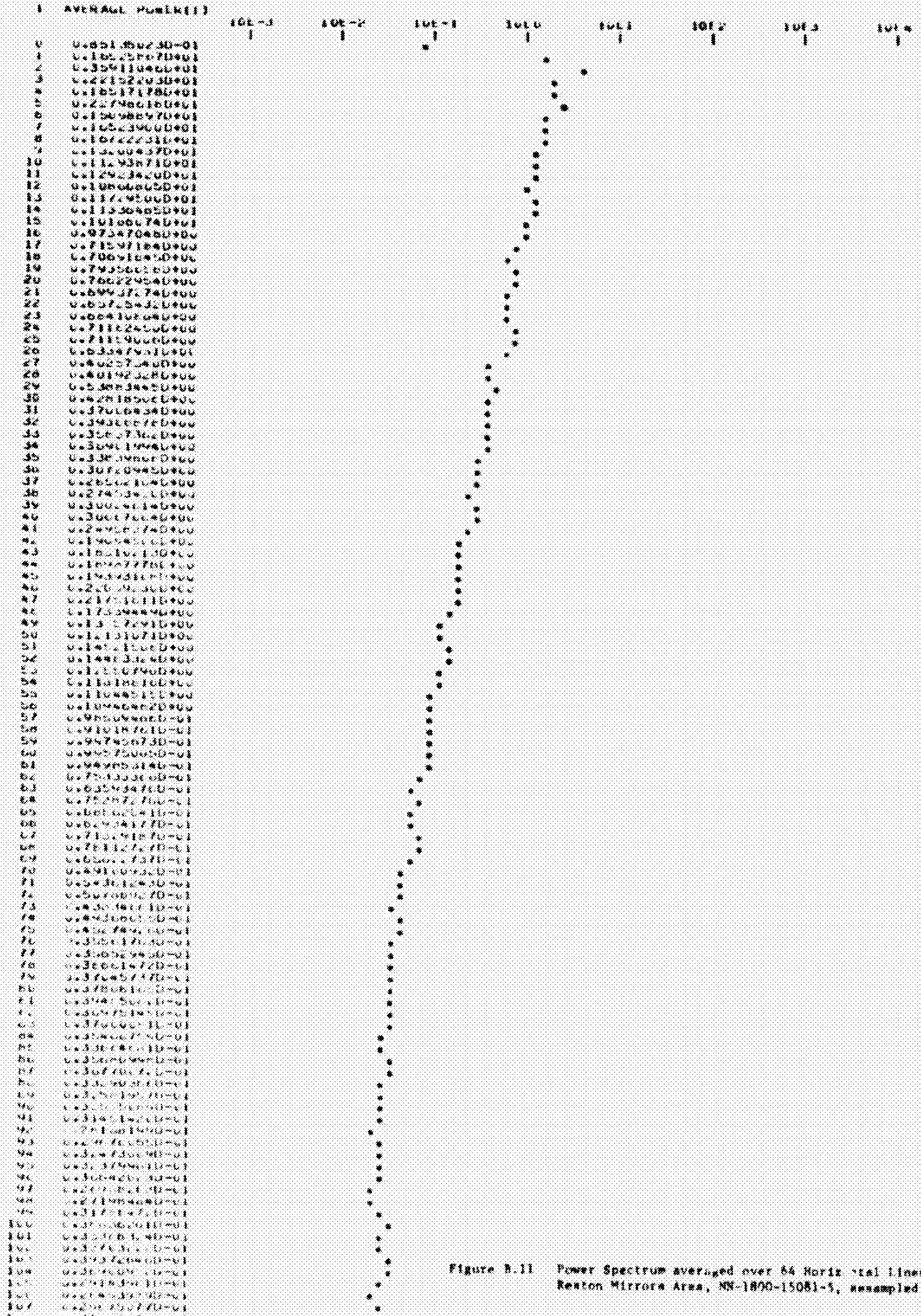

Figure B.11 Power Spectrum averaged over 64 Horizontal Lines, Reston Mirrors Area, NN-1800-15081-5, resampled at 1:1

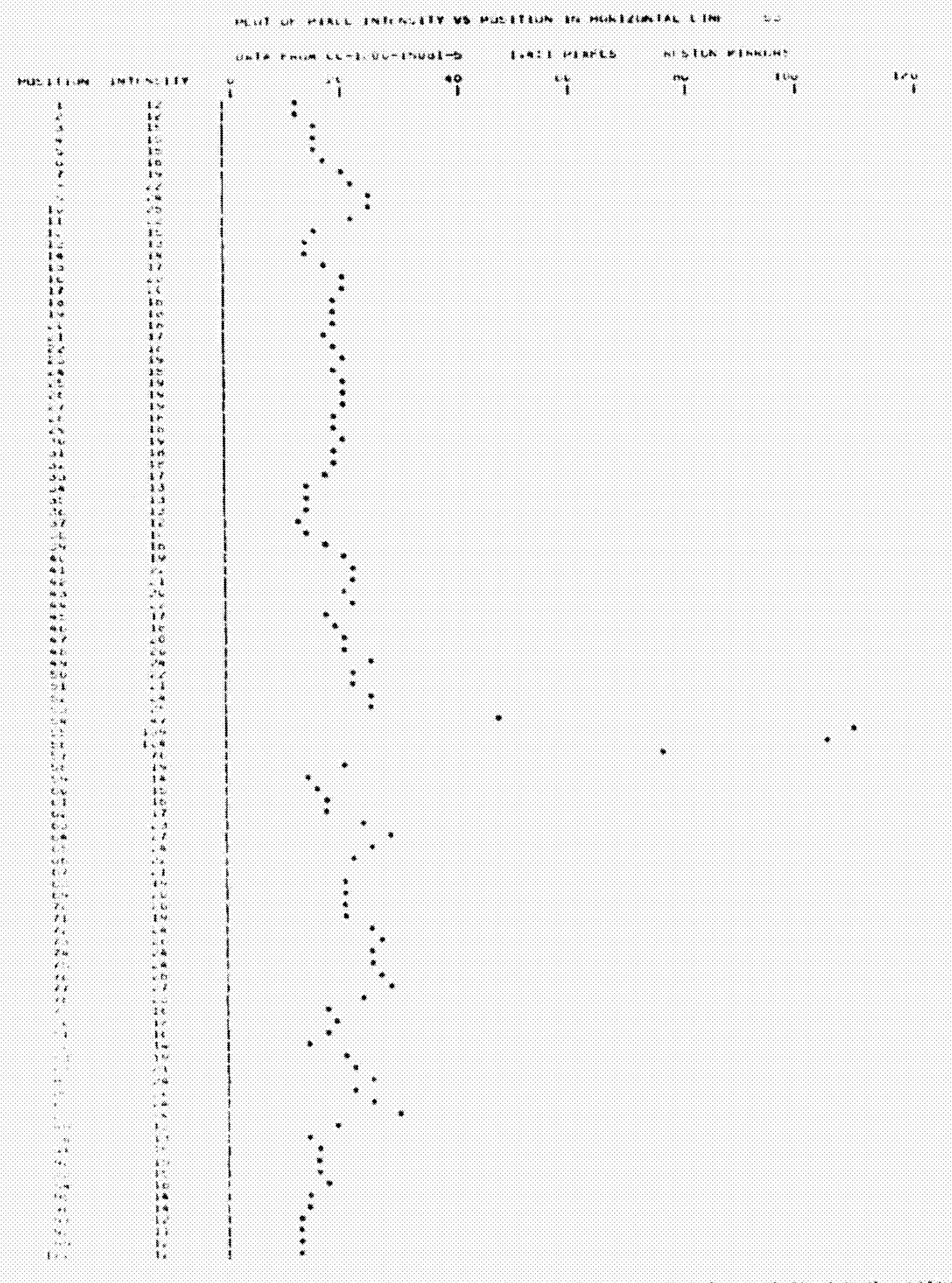

Figure B.12 Plot of Horizontal Line through Reston Mirrors, CC-1800-15081-5, Resampled at 1.4:1

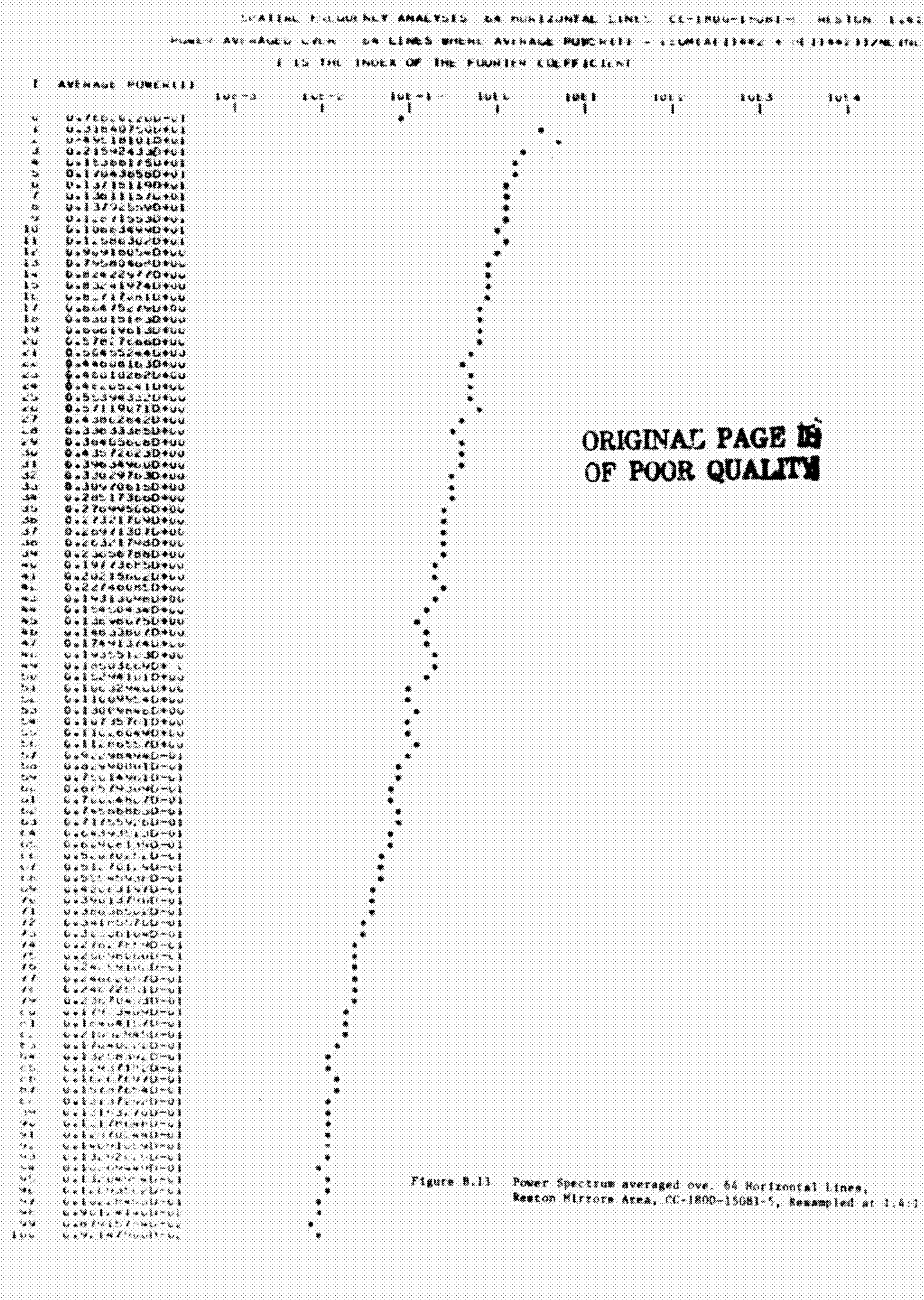

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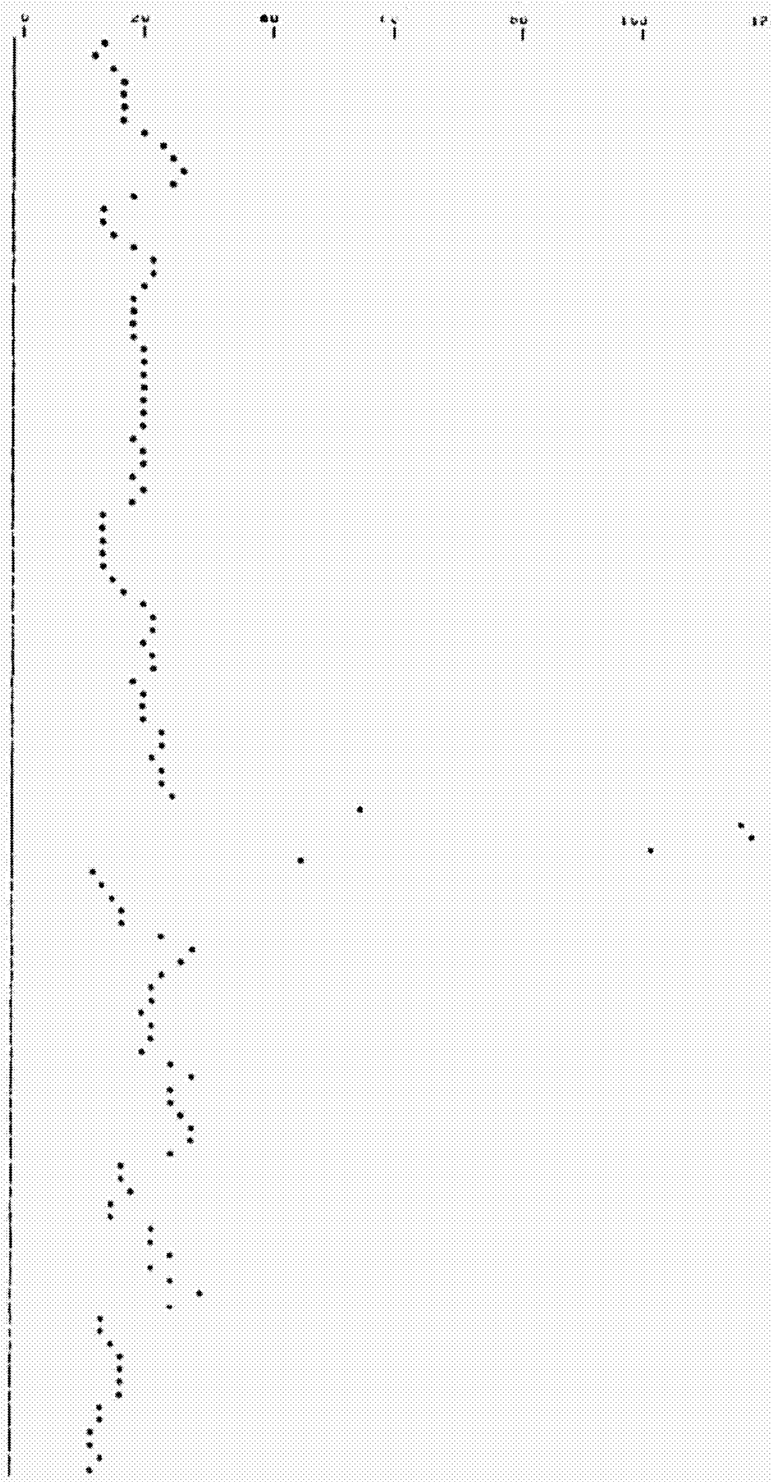
Figure B.11 Power Spectrum averaged over 64 Horizontal Lines, Reston Mirrors Area, CC-1800-15081-5, Resampled at 1.4:1

PLOT OF PIXEL INTENSITY VS POSITION IN HORIZONTAL LINE 82

DATA FROM CC-1800-15081-5   113 PIXELS   RESTON MIRRORS

POSITION	INTENSITY
1	13
2	12
3	15
4	16
5	16
6	16
7	17
8	20
9	23
10	25
11	26
12	24
13	18
14	14
15	14
16	15
17	18
18	21
19	21
20	19
21	18
22	18
23	18
24	18
25	19
26	19
27	19
28	19
29	20
30	20
31	19
32	18
33	19
34	19
35	18
36	19
37	18
38	14
39	14
40	14
41	13
42	13
43	15
44	16
45	19
46	22
47	22
48	20
49	22
50	21
51	18
52	19
53	20
54	19
55	23
56	23
57	21
58	23
59	23
60	25
61	55
62	116
63	117
64	102
65	45
66	11
67	14
68	15
69	16
70	17
71	23
72	27
73	25
74	23
75	[illegible]
76	21
77	20
78	21
79	21
80	20
81	24
82	27
83	25
84	25
85	26
86	27
87	27
88	24
89	17
90	17
91	18
92	15
93	15
94	21
95	22
96	25
97	22
98	24
99	[illegible]
100	24
101	13
102	14
103	15
104	16
105	16
106	17
107	16
108	14
109	13
110	12
111	12
112	13
113	12



THE PIXEL INTENSITY RANGE OF 0 TO 127 HAS BEEN SCALED TO 60 POSITIONS OF PLOTTING

Figure B.14   Plot of Horizontal Line through Reston Mirrors, CC-1800-15081-5, Resampled at 1:1

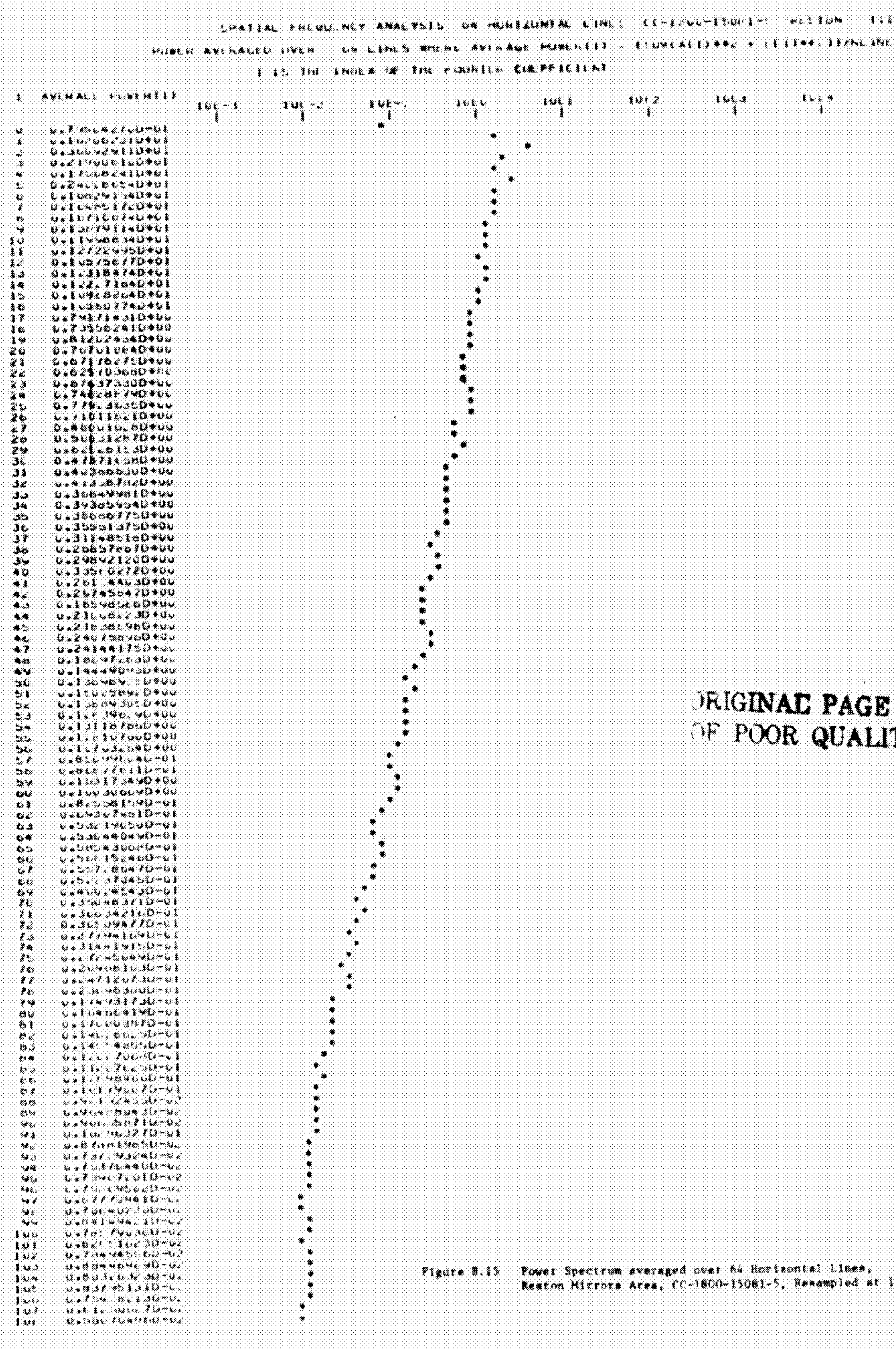
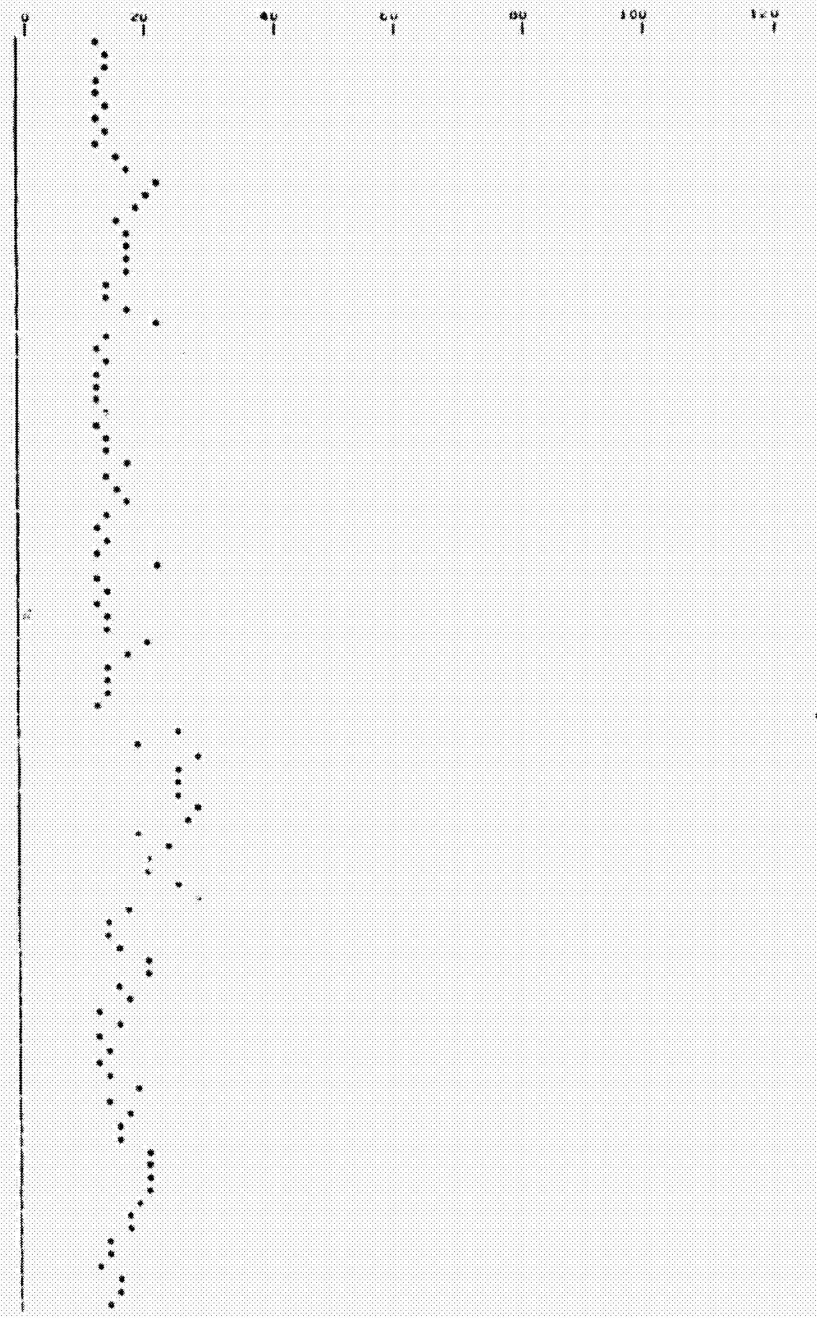


Figure B.15 Power Spectrum averaged over 64 Horizontal Lines, Reston Mirrors Area, CC-1800-15081-5, Resampled at 1:1

PLOT OF PIXEL INTENSITY VS POSITION IN VERTICAL LINE 56

DATA FROM OR-1800-15061-5 RESTON MIRRORS

POSITION	INTENSITY
1	12
2	13
3	14
4	12
5	12
6	13
7	12
8	13
9	12
10	15
11	16
12	21
13	19
14	18
15	15
16	16
17	16
18	16
19	16
20	14
21	14
22	17
23	22
24	14
25	12
26	13
27	12
28	12
29	11
30	13
31	12
32	13
33	14
34	16
35	14
36	15
37	16
38	13
39	11
40	13
41	12
42	21
43	12
44	13
45	12
46	13
47	14
48	20
49	16
50	13
51	14
52	13
53	12
54	127
55	24
56	18
57	28
58	25
59	24
60	25
61	28
62	26
63	18
64	23
65	19
66	20
67	25
68	27
69	16
70	13
71	14
72	15
73	19
74	20
75	15
76	17
77	12
78	15
79	12
80	14
81	12
82	13
83	18
84	14
85	16
86	15
87	15
88	19
89	19
90	20
91	19
92	18
93	17
94	17
95	14
96	13
97	12
98	15
99	15
100	13



THE PIXEL INTENSITY RANGE OF 0 TO 127 HAS BEEN SCALED TO 60 DISTINCT PLOT POSITIONS

Figure 8.16 Plot of Vertical Line through Reston Mirrors, OR-1800-15061-5

SPATIAL FREQUENCY ANALYSIS 64 VERTICAL LINES OR-1800-15081-5 [illegible]

POWER AVERAGED OVER 64 LINES WHERE AVERAGE POWER(I) = (SUM(A(I)**2 + B(I)**2))/NLINES

I IS THE INDEX OF THE FOURIER COEFFICIENT

I	AVERAGE POWER(I)
0	0.42679718D-01
1	0.70271320D+00
2	0.23132411D+01
3	0.30254744D+01
4	0.2071492[illegible]D+01
5	0.15999619D+01
6	0.15967295D+01
7	0.76405424D+00
8	0.64914961D+00
9	0.11331960D+01
10	0.96816699D+00
11	0.86794210D+00
12	0.97039093D+00
13	0.60960537D+00
14	0.36925795D+00
15	0.94139434D+00
16	0.95211513D+00
17	0.55793244D+00
18	0.60497896D+00
19	0.53031749D+00
20	0.49446952D+00
21	0.46463791D+00
22	0.41979356D+00
23	0.47696191D+00
24	0.39915427D+00
25	0.33447066D+00
26	0.31034681D+00
27	0.36859048D+00
28	0.34764490D+00
29	0.30715835D+00
30	0.29568390D+00
31	0.30441352D+00
32	0.33045463D+00
33	0.33949034D+00
34	0.34111149D+00
35	0.30958762D+00
36	0.27108012D+00
37	0.23965436D+00
38	0.24994119D+00
39	0.29731062D+00
40	0.28071148D+00
41	0.24378946D+00
42	0.22297991D+00
43	0.23192787D+00
44	0.24142139D+00
45	0.22209981D+00
46	0.19846124D+00
47	0.16064880D+00
48	0.17607179D+00
49	0.19796193D+00
50	0.17874657D+00
51	0.22022419D+00
52	0.23476043D+00
53	0.19444703D+00
54	0.17306059D+00
55	0.14659944D+00
56	0.15044513D+00
57	0.16793631D+00
58	0.18007112D+00
59	0.16760809D+00
60	0.15872156D+00
61	0.1560615[illegible]1D+00
62	0.1134[illegible]1D+00
63	0.14613154D+00
64	[illegible].145[illegible]0D+00
65	0.12747523D+00
66	0.13215613D+00
67	0.1499[illegible]39D+00
68	0.11966979D+00
69	0.16014467D+00
70	0.17052443D+00
71	0.16206178D+00
72	0.17942016D+00
73	0.135[illegible]D+00
74	0.13554364D+00
75	0.[illegible]41216330D+00
76	0.13692196D+00
77	0.14349480D+00
78	0.1249607[illegible]0D+00
79	0.97661774D-01
80	0.90102655D-01
81	0.10292829D+00
82	0.13312108D+00
83	0.16965859D+00
84	0.16106249D+00
85	0.13092904D+00
86	0.10195980D+00
87	0.10548049D+00
88	0.11167623D+00
89	0.11369166D+00
90	0.10354743D+00
91	0.89255805D-01
92	0.92599125D-01
93	0.94790025D-01
94	0.9[illegible]D-01
95	0.94919[illegible]D-01
96	0.10549741D+00
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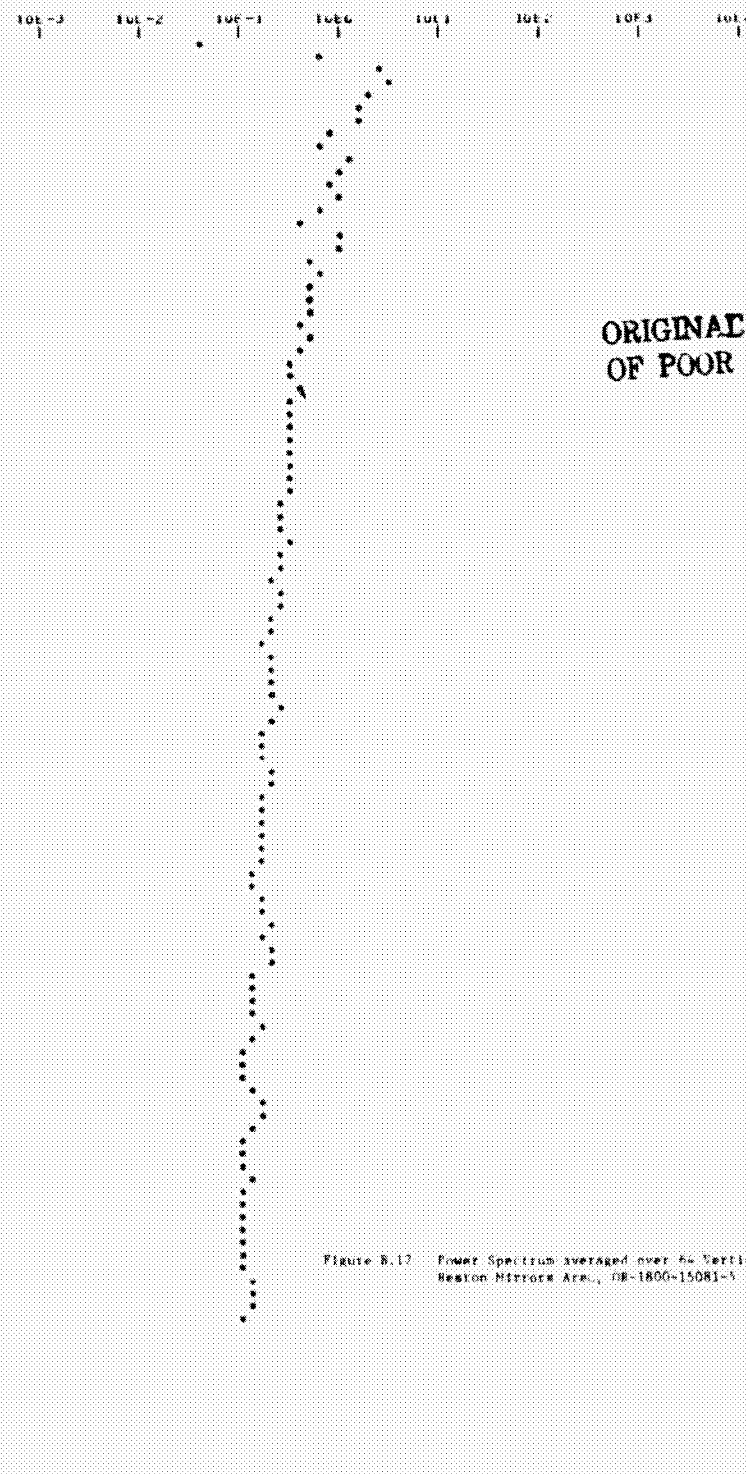

Figure B.17 Power Spectrum averaged over 64 Vertical Lines, Reston Mirrors Arm, OR-1800-15081-5

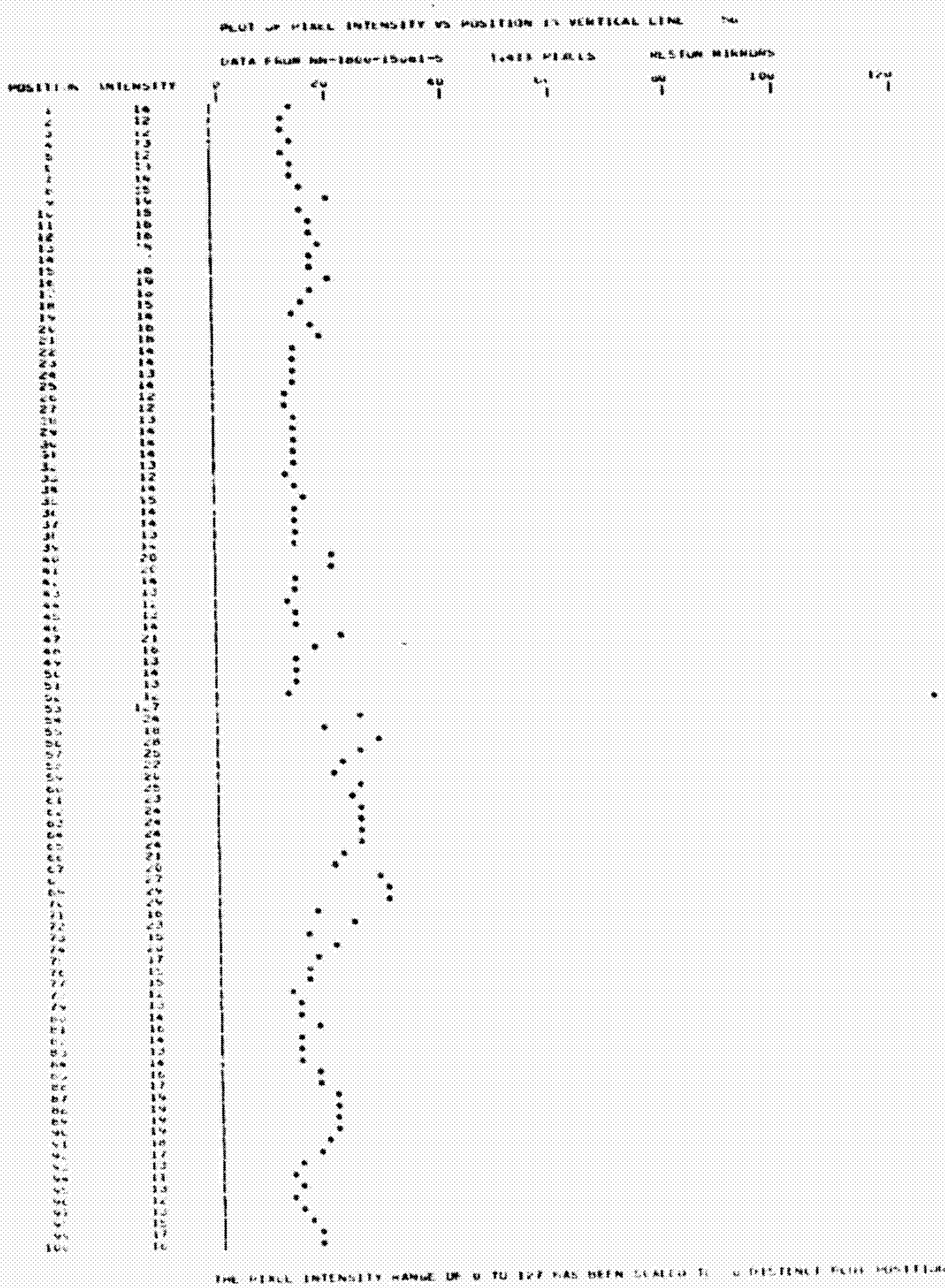

Figure B.18 P[illegible] [illegible]ertical Line through Reston Mirrors, NN-1800-15081-5, Resampled at 1.4:1

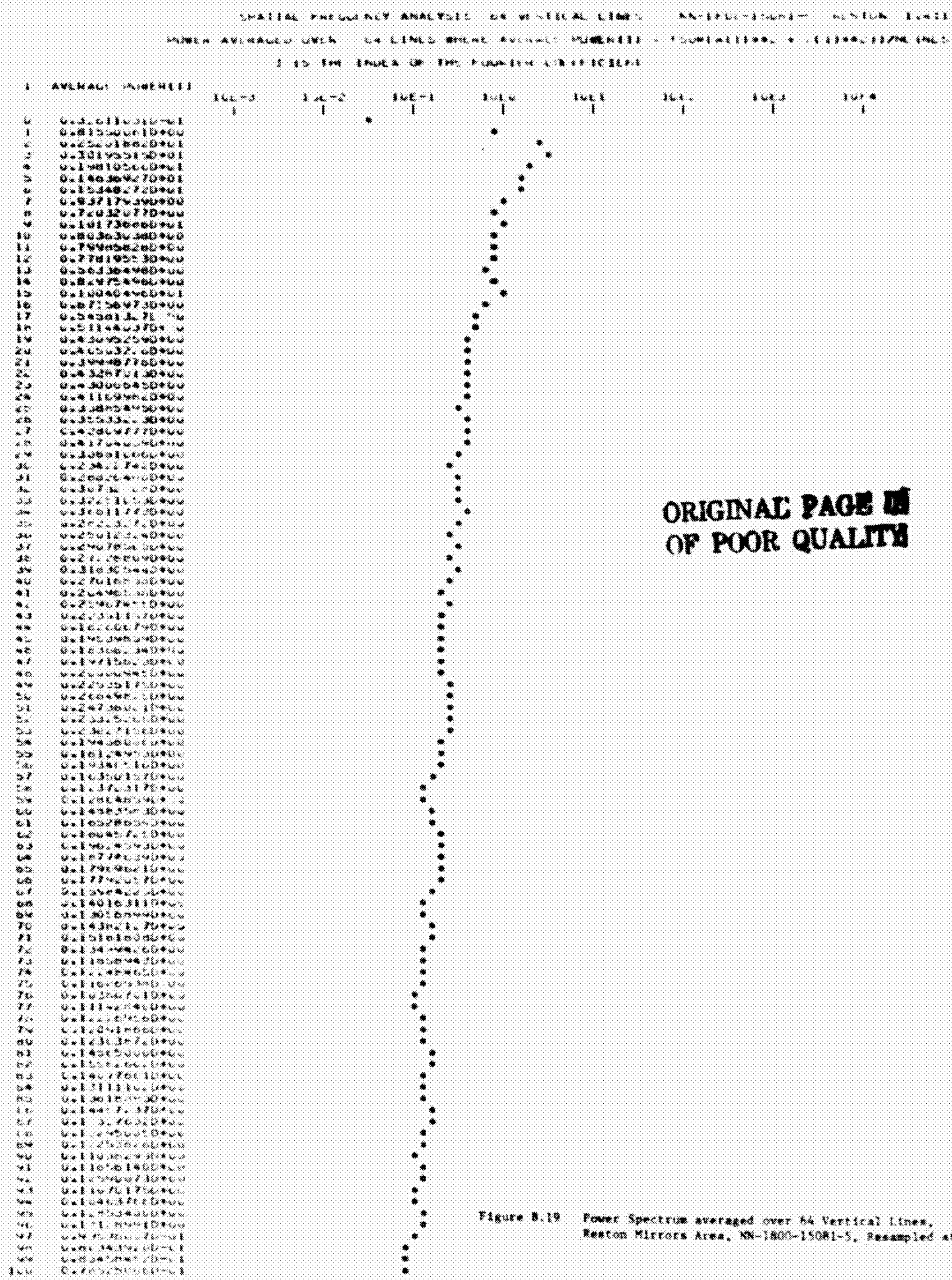

Figure B.19 Power Spectrum averaged over 64 Vertical Lines, Reston Mirrors Area, NN-1800-15081-5, Resampled at 1.5:1

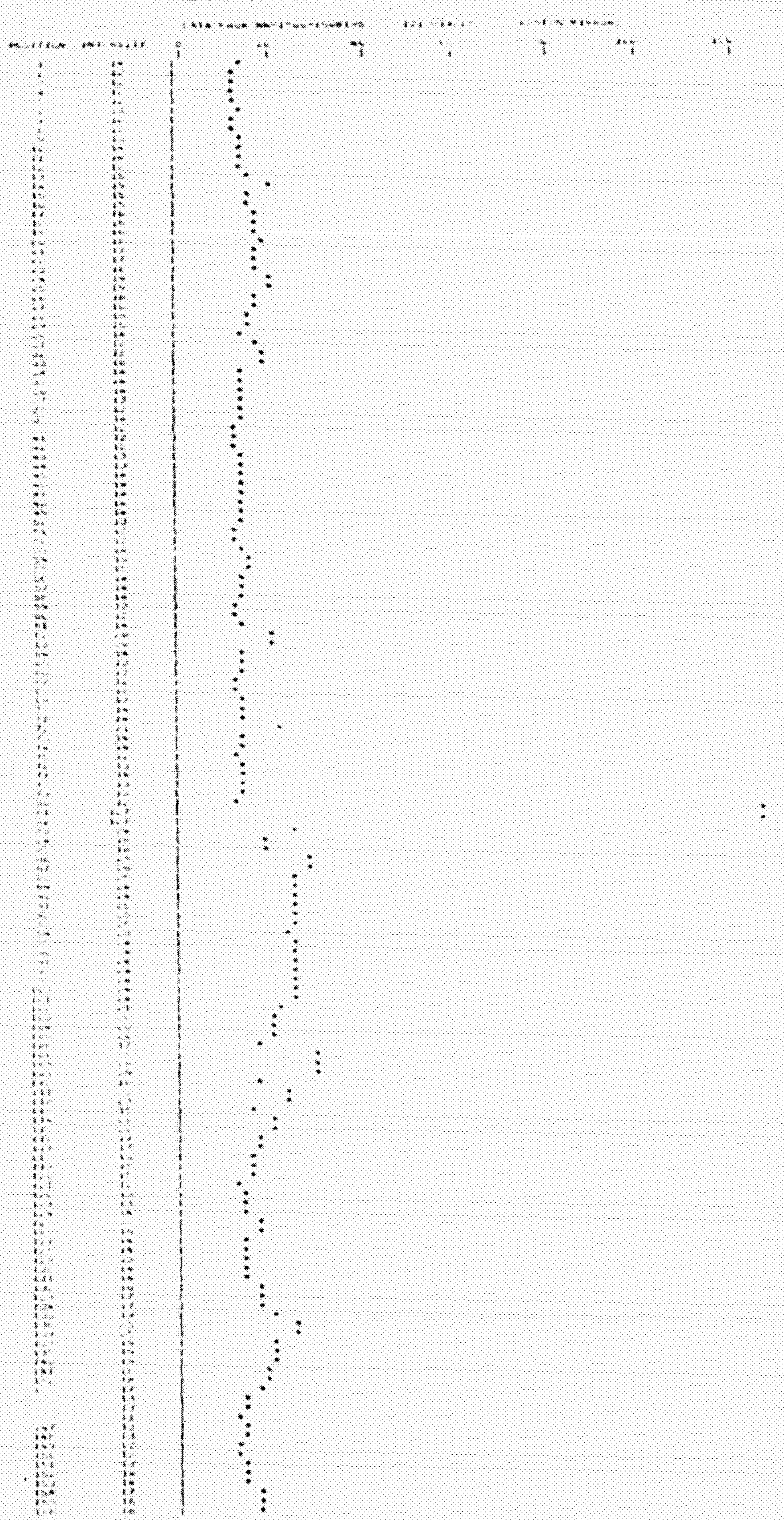

Figure 8.20 Plot of Vertical Line through Reston Mirrors,
HM-1800-15081-5, Resampled at 1:1

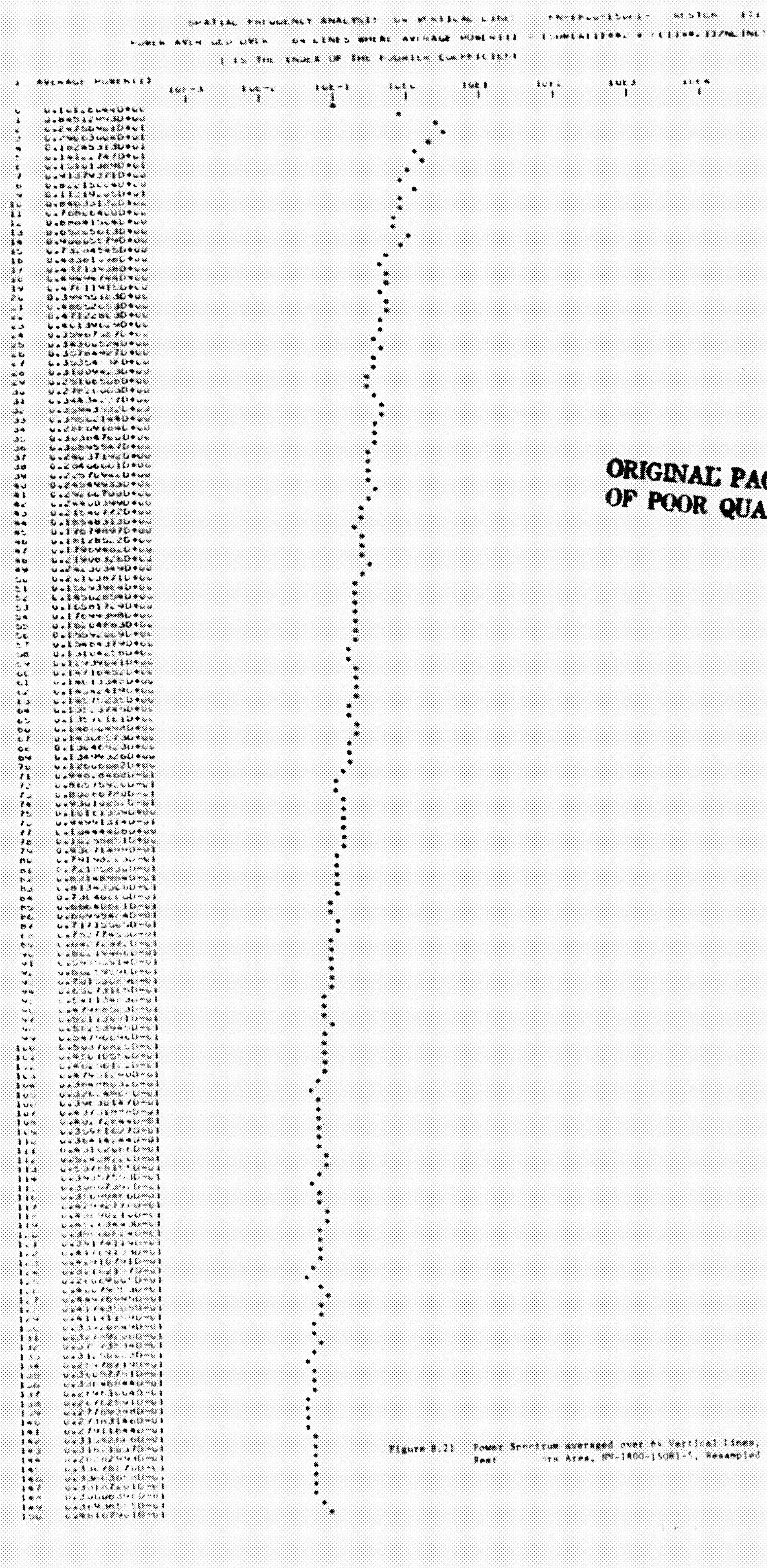

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Figure 8.21 Power Spectrum averaged over 64 Vertical Lines,
Rest [illegible] Area, HM-1800-15081-5, Resampled at 1:1

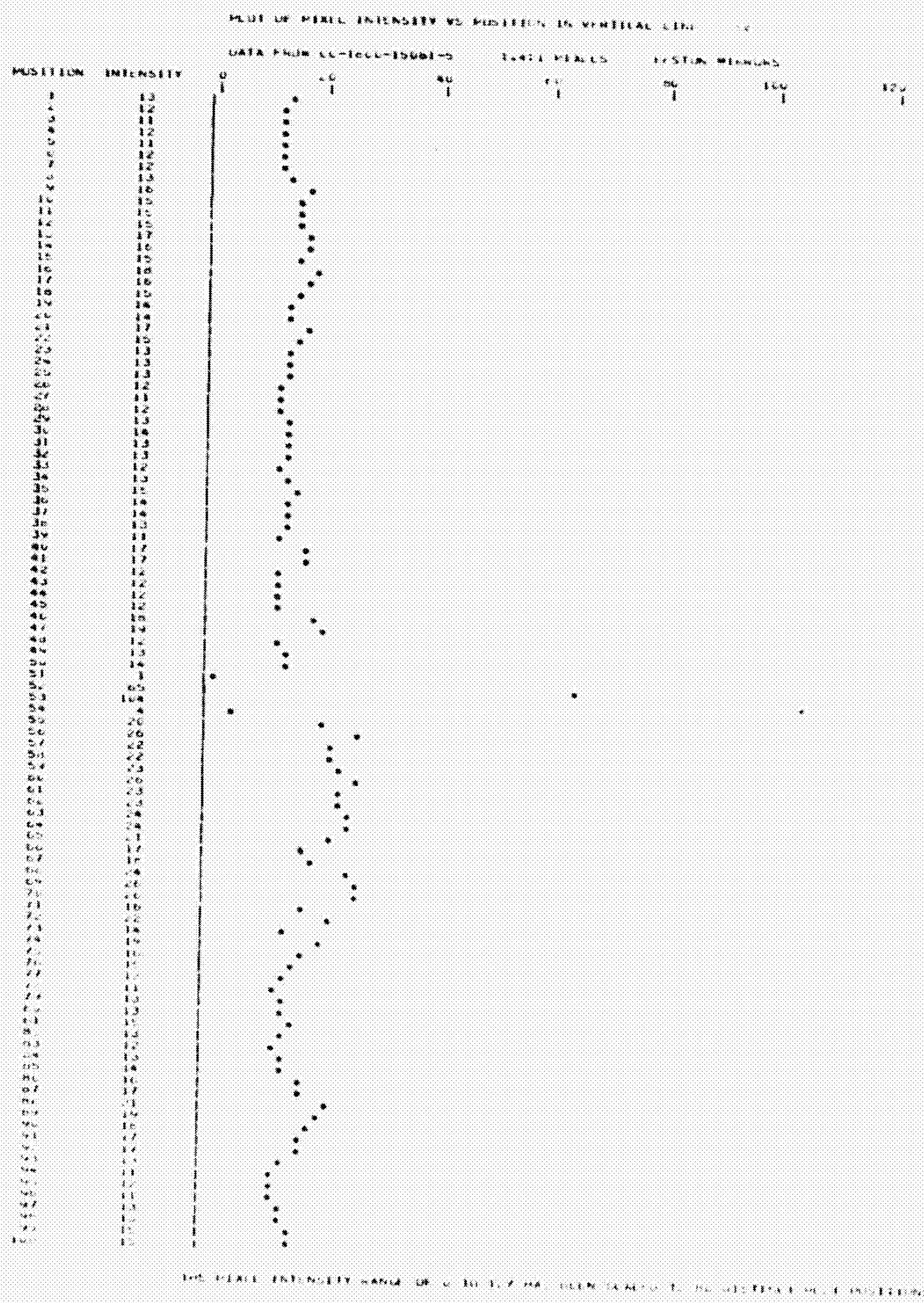

Figure 8.22   Plot of Vertical Line through Reaton Mirrors,
CC-1800-15081-5, Resampled at 1.4:1

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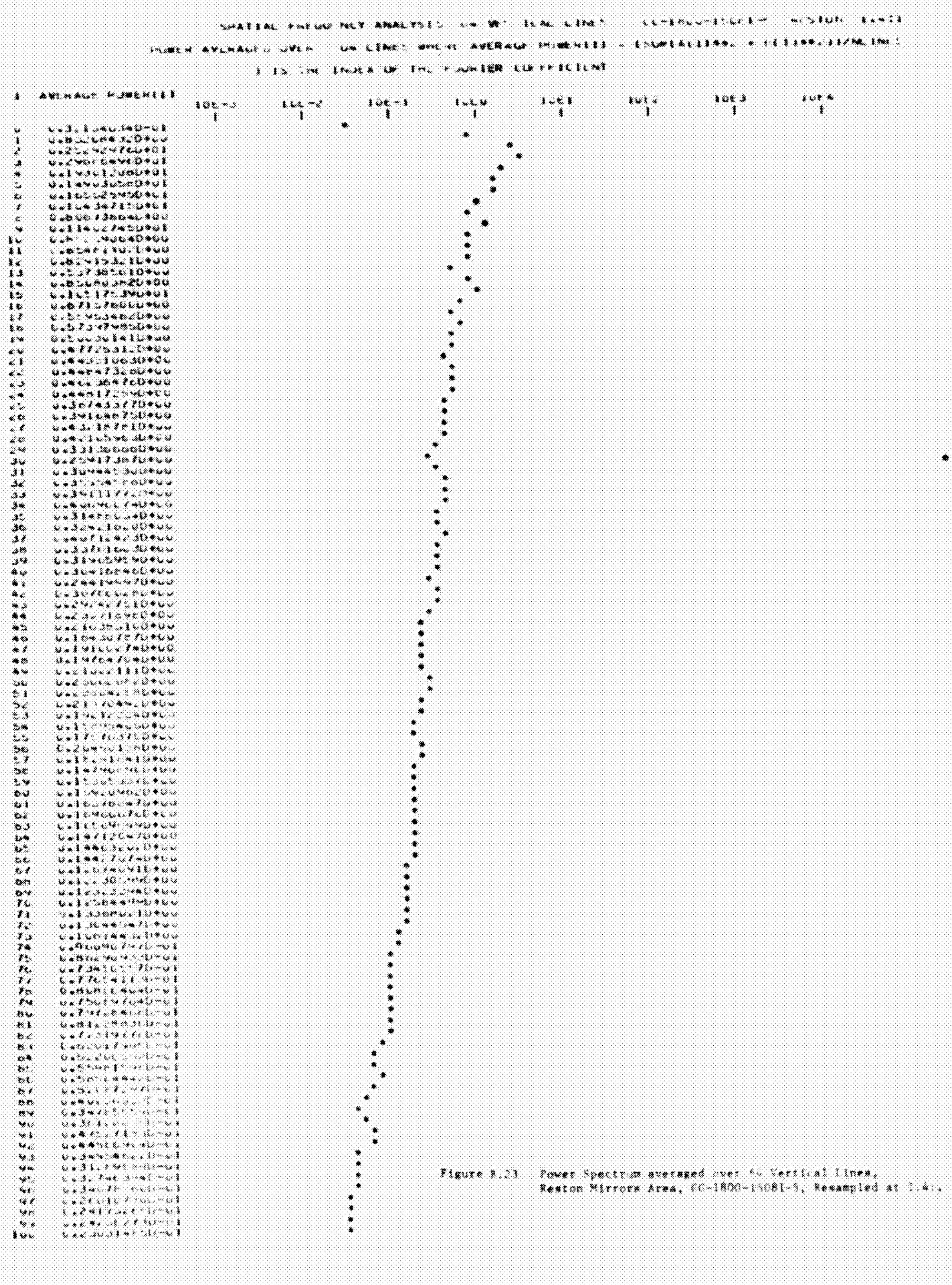

Figure 8.23 Power Spectrum averaged over 64 Vertical Lines, Reston Mirrors Area, CC-1800-15081-5, Resampled at 1.4:1.

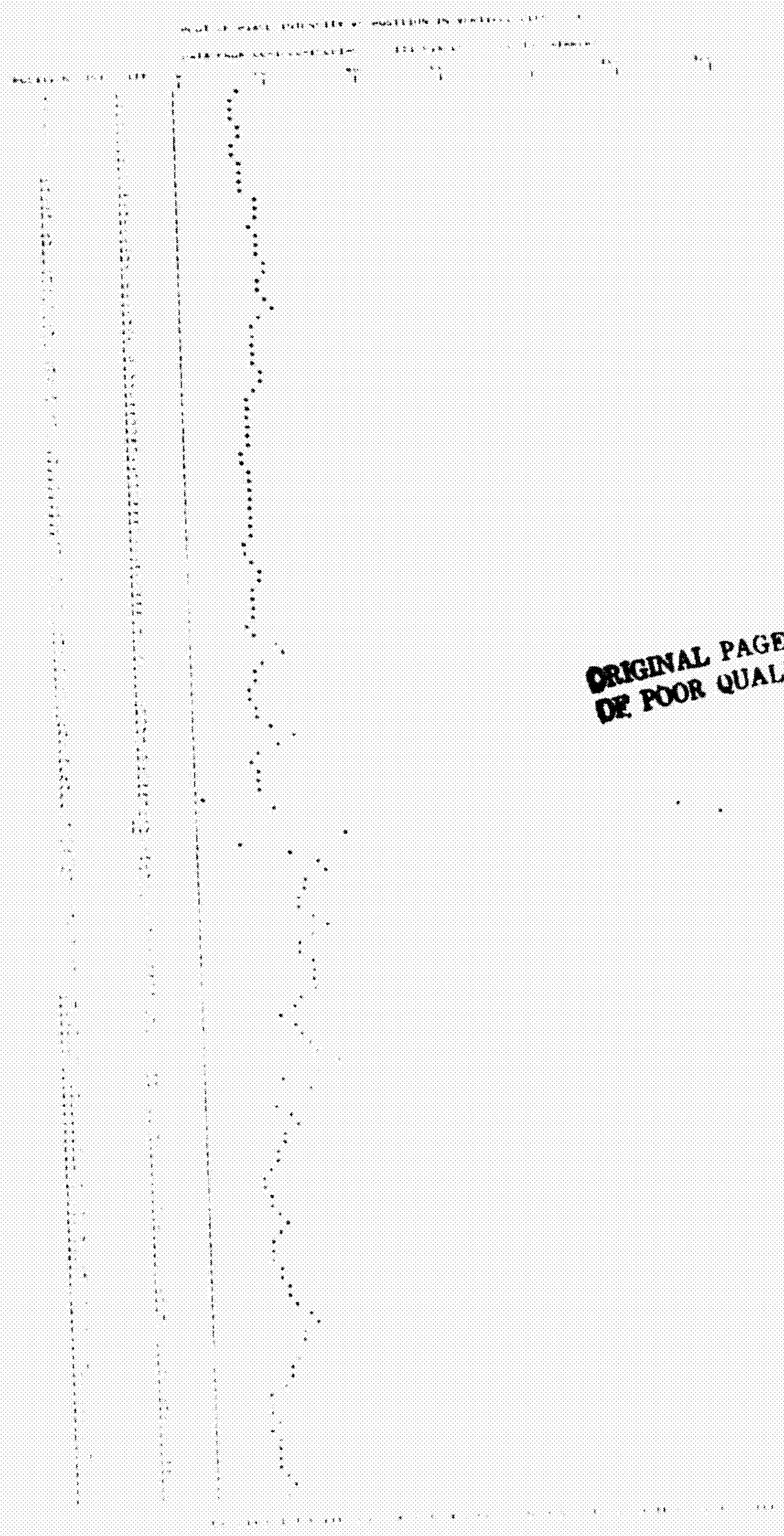

Figure 8.24 Plot of Vertical Line Through Beacon Mirrors,
-1800-15081-5, Resampled at 1:1

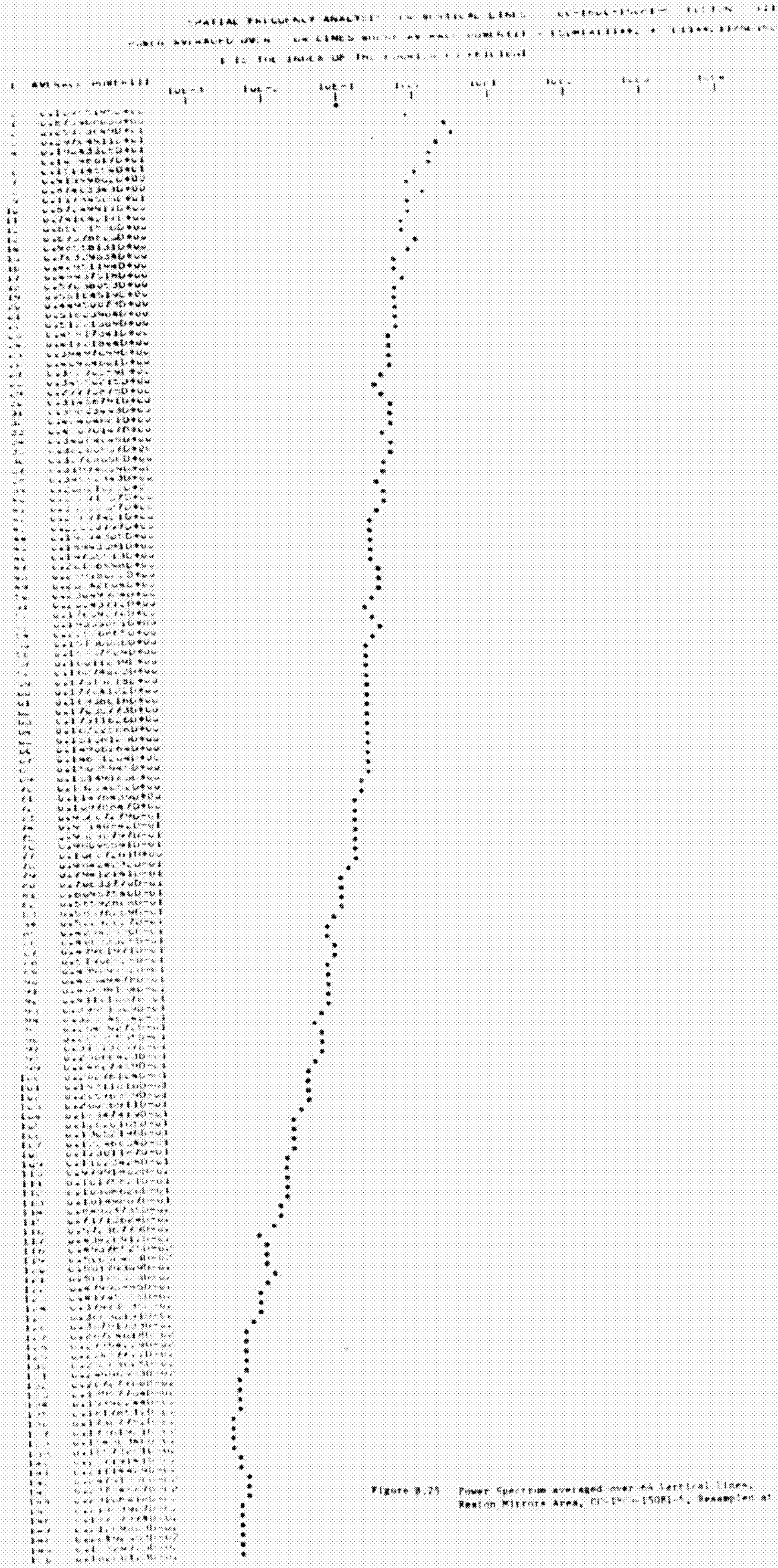

Figure 8.25 Power Spectrum averaged over 64 Vertical lines,
Region Mirrors Area, [illegible]-15081-5, Resampled at [illegible]